QTA
H364o
1887

# 1001

# QUESTIONS AND ANSWERS

ON

# PHYSIOLOGY & HYGIENE,

BY

E. A. HATHAWAY,

LEBANON, OHIO.

QTA H364o 1887

61420300R

NLM 05054200 0

NATIONAL LIBRARY OF MEDICINE

SURGEON GENERAL'S OFFICE

ANNEX LIBRARY ANNEX

ANNEX ANNEX

Section

Form 113c W.D., S.G.O. No. 291882

GOVERNMENT PRINTING OFFICE

MAR 30 1887

## BY THE SAME AUTHOR.

1001 QUESTIONS AND ANSWERS ON
U. S. HISTORY.
(Including the Federal Constitution and Amendments.)

1001 QUESTIONS AND ANSWERS ON
GEOGRAPHY.
(Embracing Descriptive, Physical, and Mathematical Geography.)

1001 QUESTIONS AND ANSWERS ON
GRAMMAR.
(With Copious Illustrations, Parsing and Analysis.)

1001 QUESTIONS AND ANSWERS ON
ARITHMETIC.
(Including nearly 300 Test Examples, with Solutions.)

1001 QUESTIONS AND ANSWERS ON
THE THEORY AND PRACTICE OF TEACHING.
(The latest and most exhaustive Book on this subject ever published.)

1001 QUESTIONS AND ANSWERS ON
PHYSIOLOGY AND HYGIENE.
(Containing a separate and exhaustive Chapter on the Physiological effects of Alcohol and Narcotics.)

Extra Cloth. Price, 50 Cts. Each.

Address B. A. HATHAWAY,
LEBANON, OHIO.

# 1001

# QUESTIONS AND ANSWERS

ON

# PHYSIOLOGY

AND

# HYGIENE.

---

BY

B. A. HATHAWAY,

Author of "1001 Questions and Answers on U. S. History," "1001 Questions and Answers on Geography," "1001 Questions and Answers on Grammar," Etc.

ARMY MEDICAL LIBRARY
291882
WASHINGTON, D. C., U.S.A.

LIBRARY OF CONGRESS,
COPYRIGHT,
MAR 30 1887
CITY OF WASHINGTON

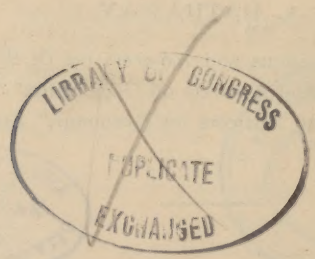
---

LEBANON, OHIO:
PUBLISHED BY THE AUTHOR.
1887.

QTA
H3640
1887

Film 7389, item 1

Entered according to Act of Congress, in the year 1887,
By B. A. HATHAWAY,
In the office of the Librarian of Congress at Washington, D. C.



## PREFATORY NOTE.

*This work, like the others of this series, is designed for use in preparing for Examinations, reviewing Pupils in School, and to be used for Reference. It will be found that Anatomy, Physiology, and Hygiene are elaborately treated of in this volume, and it is believed that the great number and variety of the questions and the succinct answers will render this book very popular. The Author has consulted a score of standard writers on Physiology, whose names will be found appended to many of the answers. The laws of many States require instruction to be given in the Public Schools on the Physiological effects of Alcoholic and Narcotic Drugs. This fact has induced the writer to make a separate division of this important subject, and to give as much space to its treatment as any other.*

FEBRUARY. 1887. B. A. H.

## CONTENTS.


| | Page |
|---|---|
| PREFACE, | 3 |
| INTRODUCTORY, | 5 |
| THE OSSEOUS SYSTEM, | 8 |
| THE MUSCULAR SYSTEM, | 16 |
| THE SKIN, | 24 |
| THE DIGESTIVE SYSTEM, | 33 |
| THE CIRCULATORY SYSTEM, | 45 |
| RESPIRATION AND THE VOICE, | 54 |
| THE NERVOUS SYSTEM, | 63 |
| THE SPECIAL SENSES, | 72 |
| PHYSIOLOGICAL EFFECTS OF ALCOHOL AND NARCOTICS, | 84 |

## INTRODUCTORY.

1. *Name the three Kingdoms of Nature.*
   The Mineral, Vegetable, and Animal Kingdoms.
2. *What are Organic Bodies?*
   Those having organs by which they grow; as, plants and animals.
3. *What are Inorganic Bodies?*
   Those that are naturally destitute of life; such as air, water, minerals, soils, etc.
4. *What does the Mineral Kingdom include?*
   All inorganic bodies.
5. *What does the Vegetable Kingdom include?*
   All those organic bodies that have no power to feel.
6. *What does the Animal Kingdom include?*
   It includes all the organic bodies that have the power to feel and of voluntary motion.
7. *Give another distinction between Organic and Inorganic Bodies*
   Organic bodies grow, require food, reproduce after their kind, and are subject to death; Inorganic bodies only grow by addition to the outside.
8. *What are Organs?*
   They are parts of an organized body.
9. *Name some of the organs of an Animal.*
   The mouth, the heart, the eye, etc.
10. *Name some of the organs of a Plant.*
    The roots, the leaves, etc.
11. *Define the term Function.*
    The work of a particular organ is called its *Function*.

12. *How does the nourishment of animals and of plants differ?*
*Animals* inhale oxygen and exhale carbonic acid gas; *Plants* absorb carbonic acid gas and throw off oxygen. *Animals* depend upon the products of the Animal and Vegetable Kingdoms for food; *Plants* depend upon those of the Mineral Kingdom.

13. *What is placed at the head of the Animal Kingdom?*
Man; because "Man is the end toward which all the Animal Kingdom has tended from the first appearance of the Palæozoic fishes."—AGASSIZ and GOULD.

14. *Define Anatomy.*
It is the science that treats of the structure, form, number, and position of the different organs.

15. *Define Physiology.*
It is the science that treats of the functions or uses of the different organs.

16. *What is Human Anatomy, or Physiology?*
If the science treats of the organs of man only, it is called Human Anatomy, or Human Physiology.

17. *What is Comparative Anatomy, or Physiology?*
If the science embraces a description of the lower animals, it is called Comparative Anatomy, or Comparative Physiology.

18. *What is Vegetable Anatomy, or Physiology?*
It is the science that treats of the different organs of *plants*.

19. *Define Hygiene.*
It is the science that treats of the Laws of Health.

20. *Of what are Organs composed?*
A variety of structures called *tissues*, which are also composed of *cells*.

21. *Define Histology.*
It is the science which treats of the minute structure of the tissues and cells of animals and plants.

22. *What is a Cell?*
It is a minute sac filled with a fluid called *protoplasm*, in which is located another sac called the *nucleus*, which also contains a sac—the *nucleolus*.

23. *What is a Tissue?*
It is the texture of which any part of the body is composed. *Tissue* is formed by the growth and reproduction of the *cells*.

24. *What is the shape and size of the Cells?*

They vary both in shape and size; they are spheroidal, flattened, and sometimes elongated; they vary in size from one one-hundred-and-twentieth to the one six-thousandth of an inch in diameter.

25. *What is a Fiber?*

It is a thread-like portion, which, in part, forms the tissues.

26. *Name the parts of a Cell.*

Cell-wall, protoplasm, nucleus, and nucleolus.

27. *What is the color of the fluid of Cells?*

It is transparent, except in those of the blood.

28. *Name the various Tissues.*

Osseous tissue, Muscular, Connective, Cartilaginous, Adipose, and Nervous tissue.

29. *Define Chemistry.*

It is the science which treats of the ultimate elements of substances.

30. *What Chemical Elements are found in the Human Body?*

Hitchcock says: "Of the sixty-five chemical elements or simple bodies known to exist, only fifteen have been found as normal constituents of the human body." They are the following:

| | | |
|---|---|---|
| 1. Oxygen. | 6. Phosphorus. | 11. Chlorine |
| 2. Hydrogen. | 7. Calcium. | 12. Fluorine |
| 3. Carbon. | 8. Magnesium. | 13. Silicon. |
| 4. Nitrogen. | 9. Sodium. | 14. Iron. |
| 5. Sulphur. | 10. Potassium. | 15. Manganese. |

31. *What elements should our food contain?*

All the fifteen ingredients.

32. *Is there any one kind of food that contains all these?*

Milk and eggs only: hence the necessity of a variety of food.

33. *Name the solids of the body.*

The bones, teeth, muscles, ligaments, cartilages, nerves, hair, nails, skin, membranes, viscera, and vessels.

34. *Define Hygrology.*

It is that part of the science of Anatomy which treats of the fluids of the body.

35. *Name some of the fluids of the body.*

Blood, chyle, lymph, saliva, gastric juice, pancreatic juice, synovia, mucous, and serum.

36. *For what purposes are the fluids in the body?*

They contain the materials from which the body is formed, and also serve as a medium for carrying off the waste and decayed matter from the system.

## THE OSSEOUS SYSTEM.

1. *What is a System?*

It is several organs of similar structure taken together.

2. *Name the systems of organs in the Human Body.*

The Osseous System, the Muscular System, the Digestive System, the Circulatory System, the Respiratory System, and the Nervous System.

3. *What is Osteology?*

It is that part of Anatomy which treats of the bones.

4. *What constitutes the Skeleton?*

The bones of the body united by the ligaments.

5. *What is a Natural Skeleton?*

It is when the bones are connected by the natural ligaments

6. *What is an Artificial Skeleton?*

It is when the bones are connected by wires or other foreign substance.

7. *What is the weight of a Human Skeleton?*

About one-tenth of the weight of the body.

8. *State the number of bones in the Human Skeleton.*

They number 208, besides the teeth.

9. *Describe the four uses of the Skeleton.*

1. It gives shape to the body. 2. It supports the body. 3. It enables us to move and extend the limbs. 4. It protects the delicate organs.

10. *Give the composition of bones.*

They are composed of both animal and mineral matter. The animal matter consists of *cartilage* and *blood vessels*, and the mineral matter consists of *phosphate of lime* and *carbonate of lime.*

11. *How does the amount of animal matter vary at different ages?*

The animal matter is much in excess in youth, while in old age the amount of mineral matter is the greatest.

12. *Name the Microscopic Elements of bones.*

Haversian Canals, Lacunæ or *Bone Corpuscles*, Canaliculi or *Bone Pores*, and Ultimate Granules.

13. *What are the Haversian Canals?*

They are minute tubes or canals traversing the bones in all directions, carrying the nutritive and watery portions of the blood

14. *Define Periosteum.*

It is the tough membraneous covering of all the bones excepting the teeth and articular extremities.

15. *What are the uses of the Periosteum?*

It furnishes nutriment for and protects the bone; it also serves as places of attachment for the ligaments and tendons

16. *What diseases find their seat in the Periosteum?*

Felon and Fever Sore.

17. *What is the distinction between the Periosteum and Endosteum?*

The former refers to the exterior covering of the bones, while there seems to be a continuation of this membrane into the cavities and openings of the bones, which is termed *Endosteum.*

18. *What classes of bones are there as to shape and solidity?*

Long, short, round, flat, irregular, solid, and hollow.

19. *What is Marrow?*

Hollow bones are filled with a yellowish fat called *Medulla* or *Marrow.*

20. *Why are some bones hollow?*

By being round and hollow, bones are lighter and at the same time strong.

21. *Why is a burned bone white and porous?*

Because the animal matter is extracted.

22. *What is "Bone Black?"*

If the animal matter be only charred, the bone will be black and brittle. From this "bone black" is manufactured.

23. *Define Cartilage.*

It is a firm yet soft and elastic substance that lacks only the mineral ingredients to become bone.

24. *Why are not the bones of children as easily broken as those of aged persons?*

Because the bones of children are cartilaginous, and their elasticity will break the shock of a fall, which, in old age, would fracture the bone.

25. *How may a bone be tied into a knot?*

By putting a bone into muriatic acid the mineral matter will be removed, and the remaining cartilage will be so flexible that it can be tied into a knot.

26 *What is Ossification?*

The bone in early youth is entire cartilage, which gradually *ossifies*, or turns to bone.

27. *What is the only bone which is completely ossified at birth?*

It is the *petrous* bone, which contains the organs of hearing.

28. *What is the connection between any two bones called?*

A joint or articulation.

29. *What are the Rickets?*

The disease affects children, and is characterized by a weakness of the bones, bulky head, crooked spine and limbs, depressed ribs, etc. The cause appears to be a lack of mineral matter in the bones.

30. *What are the Fontanelles?*

They are spaces occupied by cartilage, and situated at the union of the bones of the cranium of a new-born child

31. *Into what groups may the bones of the body be divided?*

Bones of the Head, the Trunk, and the Extremities.

32. *How are the bones of the head divided?*

Into those of the Skull, the Face, and the Ear.

33. *Name the bones of the Skull.*

There are eight: One Frontal (the forehead), two Temporal (the part known as the temples), two Parietal (the top

part of the head), one Occipital (the posterior part of the skull), one Sphenoid, and one Ethmoid.

34. *Name the bones of the Face.*

There are fourteen: Two Nasal (forming the bridge of the nose), two Molar (cheek-bones), two Palate, two Lachrymal, two Turbinated (in the nostrils), two Superior Maxillary (upper jaw), one Inferior Maxillary (lower jaw), and one Vomer (that which separates the nostrils from each other).

35. *Name the bones of the Ear.*

In each ear are three small bones, which aid in hearing: The Malleus (Mallet), the Incus (Anvil), and the Stapes (Stirrup). These are so named because they resemble those instruments.

36. *What is that portion of the face called commonly known as the Ear?*

It is called the Pinna.

37 *Where is the Petrous bone?*

It is that portion of the Temporal bone in which the internal organs of hearing are located.

38. *Describe the construction of the Skull-bones.*

They are composed of two plates with a spongy bone-substance between. The external plate is fibrous and tough; the internal plate is dense and hard.

39. *What is a Suture?*

The bones of the skull are joined by notched edges, called *sutures*.

40. *What is the object of the Skull?*

To form a covering for the protection of the brain and the four organs of sense: Sight, Smell, Taste, and Hearing.

41. *Which one of the bones of the Head is movable?*

The Inferior Maxillary, or Lower Jaw.

42. *What are the bones of the Trunk?*

There are fifty-four: Twenty-four ribs, twenty-four bones in the Spinal Column, four in the Pelvis, the Sternum (breast-bone), and the Os Hyoides (at the base of the tongue).

43. *What cavities does the Trunk contain?*

The Thorax (chest), and the Abdomen (belly).

44. *How are the Ribs classified?*

As True ribs and False ribs. Of the first class, there are seven on each side, connected with the sternum or breast-bone by means of cartilage; of the second class, there are five on each side, three of which are connected with each other in front by cartilage, and the remaining two are not united in front at all, and are therefore called Floating ribs.

45. *Of what is the Spinal Column composed?*

Of twenty-four bones called *Vertebræ*. They are so arranged that a tube or canal is formed through the whole column for the *Medulla Spinalis* (spinal cord).

46. *Into what classes are the Vertebræ divided?*

Three classes: Cervical (the seven vertebræ of the neck), Dorsal (the twelve of the back), and Lumbar Vertebræ (the five vertebræ of the loins).

47. *Describe the Sternum.*

It forms the front of the Thorax or chest. In infancy the sternum consists of several pieces, but in later years it becomes one bone.

48. *How is the Thorax formed?*

By the sternum in front, the ribs at the sides, and the dorsal vertebræ at the back.

49. *What organs does the Thorax contain?*

The heart, the lungs, and the large blood-vessels.

50. *What organs does the Abdomen contain?*

The stomach, liver, kidneys, and the intestines.

51. *What is the Atlas?*

It is the first vertebra of the neck, articulating with the occipital bone.

52. *How many and what are the bones of the Pelvis?*

There are four: Sacrum, Coccyx, and two Innominata (nameless bones).

53. *What is the Sacrum?*

It is a large bone, having the appearance of five vertebræ grown together, upon which the lowest Lumbar vertebra rests. It is so called because the Ancients offered it in sacrifice.

54. *Describe the Coccyx.*

It is the bone just below the Sacrum. In middle life it is composed of four pieces or vertebræ, which unite in one

bone in after life. The Sacrum and Coccyx (so called because of its resemblance to the cuckoo's bill) are continuations of the Spinal Column, and are sometimes called "false vertebræ."

55. *Describe the Innominata.*

The two Innominata (nameless bones) are the hip-bones. In each one of them is a deep socket for the head of the thigh-bone.

56. *What two sets of limbs branch from the Trunk?*

The upper limbs or *Upper Extremities*, and the lower limbs or *Lower Extremities.*

57. *State the number and give the names of the bones of the Upper Extremities.*

There are sixty-four bones: The Scapula, Clavicle, Humerus, Radius, Ulna, Carpus, Metacarpus, and Phalanges.

58. *Name the bones of the Shoulder.*

The Scapula (shoulder-blade), and the Clavicle (collar-bone).

59. *Describe the Scapula.*

It is a thin, flat, triangular bone placed on the back part.

60. *Describe the Clavicle.*

It is a long, slender bone attached at one end to the Sternum, and at the other to the Scapula

61. *What are the bones of the Arm and Forearm?*

The Humerus of the arm, and the Radius and Ulna of the forearm.

62. *Describe the Ulna.*

It is the small bone of the forearm, and occupies the inner side. It articulates with the Humerus at the elbow

63. *Describe the Carpus.*

The Carpus, or "wrist bones," consists of two rows of irregular bones; one row articulating with the forearm, and the other with the hand. There are eight bones.

64. *Describe the Metacarpus?*

*Meta* means *beyond*, therefore Metacarpus signifies the bones beyond the Carpus. They are five in number, and form the palm of the hand. They articulate at one end with the wrist-bones, and at the other with the thumb and finger-bones.

65. *What are the Phalanges?*

The Phalanges, or "finger-bones," are fourteen in number, each finger having three bones, and the thumb two. They are named in order: The Thumb, the Index, the Middle, the Ring, and the Little finger.

66. *Name the bones of the Lower Extremities.*

There are sixty bones: The Femur, the Patella, the Tibia, the Fibula, the Tarsus, the Metatarsus, and the Phalanges.

67. *Describe the Femur.*

The Femur, or "thigh-bone," is the largest and strongest bone in the skeleton. It articulates at one end with the hip-bone, and at the other with the Tibia at the knee.

68. *Describe the Patella.*

The Patella, or "knee-pan," is a small chestnut-shaped bone firmly placed over the joint.

69. *Describe the Tibia*

The Tibia, or "shin-bone," is situated at the front part of the leg, and articulates both with the Femur and the foot. It is triangular in shape.

70. *Describe the Fibula.*

It is smaller than the Tibia, though similar in shape, and is situated on the under side of the leg. It is bound to the Tibia at both ends.

71. *Describe the Tarsus.*

The Tarsus consists of seven irregular bones, and is that part of the foot to which the leg is articulated. The Tarsus of the foot corresponds to the Carpus of the hand.

72. *What is the Os Calcis?*

It is the name of the heel-bone, the largest bone of the Tarsus.

73. *What is said of the Metatarsus?*

These are five in number, and they correspond to the Metacarpus of the hand.

74. *What is said of the Phalanges?*

The Phalanges of the toes are also like those of the hand. These are fourteen in number.

75. *What is the longest bone in the body?*

The Femur

76. *What is a Joint?*

It is the union of two or more bones.

77. *What three groups of Joints were proposed by Galen, and is still generally adopted?*

(1) Immovable (Synarthrosis);
(2) Mixed (Amphiarthrosis);
(3) Movable (Diarthrosis).

78. *Give examples of Immovable Joints.*

The articulations or unions of the plates of the skull by sutures or ragged edges; between the two upper maxillaries; between the vomer and sphenoid, and between the teeth and the jaws.

79 *What are Mixed Joints?*

Those in which the surfaces of the bones are united by an intermediate soft substance; as, two vertebræ.

80. *Describe Movable Joints.*

They are those which are freely movable, and for that purpose are provided with cartilage, synovial membranes, and connecting ligaments.

81. *What three kinds of Movable Joints?*

Planiform, Hinge, and Ball and Socket.

82. *What kind of motion in Planiform Joints?*

The movement is more or less gliding, as in the collar-bone.

83. *What kind of motion in the Hinge Joint?*

Backward and forward only, as at the knee, elbow, and wrist.

84. *What kind of motion in the Ball and Socket or Rotary Joint?*

A free movement in all directions, as found in the hip and shoulder joints.

85 *Define Synovia.*

The fluid secreted into the cavities of joints for the purpose of lubrication.

86. *What is the Synovium Membrane?*

A thin membrane covering the ends of the bones, and secreting the lubricating fluid.

87. *What is a Sprain?*

A straining, twisting, or tearing of the ligaments of a joint.

88 *What is a dislocation of a Bone?*

A rupture of the tissues of a joint so that the head of the bone is driven out of its socket into some other place.

89. *What is a Simple Fracture?*

A fracture by which the bone only is divided.

90. *What is a Compound Fracture?*

A breaking of the bone with a wound of the integuments—the bone generally protruding.

## THE MUSCULAR SYSTEM

1. *Define Muscle.*

Animal tissue, generally known as flesh or lean meat.

2. *What is the structure of Muscles?*

They consist of parallel or nearly parallel fleshy bundles, enclosed in coverings of cellular tissue capable of being indefinitely divided.

3. *Give the Microscopic Structure of Muscles.*

The bundles are called Fasciculi, and are made up of still smaller fibers, called Ultimate Fibers, and these are made up of still smaller fibers, called Fibrils.

4. *Describe the Ultimate Fibers.*

They seem to be polygonal in form, and have an average diameter of about one four-hundredth of an inch.

5. *Describe the Fibrils.*

They are only about one ten-thousandth of an inch in diameter, and are composed of rows of small cells arranged like a string of beads.

6. *What is found in the cells of the Fibrils?*

A fluid or semi-fluid mass of living matter called protoplasmic matter.

7. *How many Fibrils in an Ultimate Fiber?*

About 650 on the average.

8. *What is the characteristic property of Muscles?*

Contractibility.

9. *What is the law of their contraction?*

That they shall contract towards the center.

10. *Give the different forms of Muscles.*
(1) Spindle-shaped, (2) radiate, (3) penniform, (4) bi-pen niform, and (5) sphincter or orbicular.

11. *What is the Spindle-shaped Muscle?*
One terminating at each extremity in a tendon, and is smaller at the ends than in the middle.

12. *What is a Radiate Muscle?*
One with the fibers arranged like the rays of a fan

13. *What is a Penniform Muscle?*
One with the fibers disposed on one side of a tendon.

14. *What is a Bi-penniform Muscle?*
One with the fibers disposed on both sides of a tendon like a feather.

15. *What is a Sphincter Muscle?*
One running in a circular or orbicular direction.

16. *What is the Origin of a Muscle?*
Its fixed point or commencement.

17. *What is the Insertion of a Muscle?*
Its attachment to the part which it moves.

18. *How many Muscles in man?*
More than 500, being more than double the number of bones.

19. *How are they usually arranged?*
In pairs; that is, both sides of the body have similar muscles

20. *How many single or unmated Muscles?*
Some authors say twelve, others thirteen.

21. *What purpose is served by arranging the muscles in pairs?*
Motion in opposite directions. When one muscle contracts its antagonist relaxes.

22. *What are Extensors?*
Muscles passing over the back of a joint.

23 *What are Flexors?*
Muscles lying in front of a joint.

24. *Define Perimysium.*
The membranous covering investing each muscle

25. *Define Myolemma.*
The thin, transparent sheath enclosing each fiber of a muscle.

26. *What two classes of Muscles?*

Striated and Non-striated. The former are also called Voluntary, and the latter Involuntary.

27. *What is a Voluntary Muscle?*

One that in its normal action is controlled by the will, as the flexors and extensors of the arm.

28. *What is an Involuntary Muscle?*

One acting independently of the will, as the heart.

29. *Name a muscle both Voluntary and Involuntary.*

The eye-lid.

30 *Define Vis Musculosa.*

It is muscular power, or the contractibility of the muscle.

31. *Name four kinds of Stimulus exciting muscles to action.*

(1) Mechanical, as the touch of a sharp instrument. (2) Chemical, as acids and alkilies. (3) Electrical, as in shocks. (4) Vital, originating in or acting through the nervous system.

32. *What is a Tendon?*

A hard and strong cord by which a muscle is attached to a bone.

33 *Name some of the characteristics of Tendons.*

They are strong, compact, insensible, flexible, but inelastic.

34. *What purpose do Tendons serve?*

They convey the contractile power of muscles to the bones and are found where great strength in a small compass is desired.

35. *How are the Muscular Fibers attached to the Tendons?*

To the sides of the tendon, so that more of them can act upon the bone.

36. *Why is a Tendon better suited to pass over a joint than a muscle?*

It is small, and is more easily lodged in some groove, and is not sensitive to pain.

37. *How far do the Tendons of the muscles of the arm reach towards the hand?*

Only to the wrist, whence finer cords pass to the fingers

38. *When is a horse hamstrung?*

When the tendon of the heel is cut.

39. *What is the tendon of the heel called?*

The Tendon of Achilles.

40. *What is the origin of this name?*

The fable runs that the mother of Achilles, while he was an infant, held him by the heel when she dipped him into the River Styx to render him invulnerable. His heel, not being wet, was his only vulnerable point.

41. *Why are the bones enlarged at the joints?*

To afford greater surface for the attachment of the muscles.

42. *What is the Muscular Sense?*

The power we possess of judging of the weight of anything by lifting it or balancing it in the hand.

43. *When is the Muscular Sense called into action unconsciously?*

In walking, standing, skating, dancing, etc., we regulate by it without conscious volition the force employed.

44. *How are the Voluntary Muscles controlled and guided?*

They are subject to the control of the Will and the guidance of the Muscular Sense. The Will determines an act; the Muscular Sense the effort necessary to its performance.

45. *How do the Involuntary Muscles act?*

Wholly independent of the will, although some of them may be temporarily controlled when occasion requires it.

46. *Give an example of the voluntary control of an operation usually entrusted to involuntary muscles.*

Respiration may be temporarily controlled.

47. *Is it possible to suspend the action of the heart?*

In rare cases it has been done for a short time at will.

48. *What peculiarity is there in the structure of the heart?*

Involuntary muscles are non-striated, yet the heart is composed of striated muscle.

49. *What can you say of the weight of muscles in man?*

They weigh more than all the rest of the body.

50. *What is found in the muscles in greatest abundance?*

Water; in four pounds of lean meat or flesh, three pounds are water.

51. *What is the general shape of the muscles on the head?*

Broad and flat.

52. *Give the shape of the muscles of the extremities.*

Usually long and tapering.

53. *Give examples of hollow muscles.*
The heart and stomach.

54. *What muscle becomes hard and strong in the blacksmith's arm?*
The biceps.

55. *What is the Biceps of the arm?*
The muscle which flexes or bends the arm towards the body.

56. *Why is it so called?*
Because it has two heads or origins.

57. *Where are its origins attached?*
At the shoulder joint.

58. *To what is the lower tendon of the Biceps attached?*
To the humerus.

59. *What is the antagonist of the Biceps called?*
Triceps (three heads).

60. *What is the purpose of the Triceps?*
It extends the forearm.

61. *Describe the action of the Pronator.*
It turns the forearm inward.

62. *What muscle turns the forearm outward?*
The Supinator.

63. *What muscle is employed in bending the wrist forward?*
The Flexor Carpi Radialis.

64. *What one in bending the wrist towards the ulna?*
The Flexor Carpi Ulnaris.

65. *What muscles are employed in extending the hand?*
Extensor Carpi Radialis and Extensor Carpi Ulnaris.

66. *What muscles open and close the fingers?*
Flexor Digitorum and Extensor Digitorum

67. *Is the Biceps Muscle in the leg a Flexor or Extensor?*
Flexor.

68. *Name two Flexor Muscles of the leg.*
Biceps and Gracilis.

69. *Name two Extensor Muscles of the leg.*
Rectus and Vastus.

70. *What can you say of the number of muscles in the foot?*

They are few in number compared with those in the hand. They bend or extend the toes.

71. *What short muscle in the sole of the foot has a long name?*

The massa carnea Jacobi Sylvii (the fleshy mass of James Sylvius), named from the anatomist who first pointed out its office.

72. *What is the purpose of this muscle?*

It sends out four tendons to join other tendons coming from the calf of the leg to assist in bending the toes.

73. *What is the name of the large muscle known in animals as the Tender Loin?*

Psoas Magnus, or the great loin muscle.

74. *What is the office of this muscle?*

To draw the thigh forward.

75. *What is the antagonist of the Psoas Magnus?*

The Gluteus.

76. *What is the office of the Gluteus?*

To move the thigh backward.

77. *What is characteristic of the Fibers of the Gluteus?*

They are the coarsest in the whole body, showing that they are designed for strength and not celerity of motion.

78. *Name four muscles in the neck.*

Sterno-Cleido-Mastoid, Digastricus, Scaleni, and Constrictor.

79. *What is the office of the Sterno-Cleido-Mastoid?*

Draws the head forward.

80. *What is the office of the Digastricus?*

Draws the jaw down.

81. *What is the office of the Scaleni?*

Bends the neck from side to side.

82. *What is the office of the Constrictor?*

Moves the pharynx in swallowing.

83. *What muscles elevate the ribs?*

Intercostal and Serratus Magnus.

84. *What muscle raises the arm?*

The Deltoid.

85. *What muscle lowers the arm?*

The Teres Major.

86. *What muscle draws the arm forward?*

The Pectoral muscle.

87 *What is the office of the Diaphragm?*

Separates the chest from the abdomen, and enlarges the chest in breathing.

88 *What muscles form the walls of the Abdomen?*

The Oblique muscles.

89. *What is the office of the Erector Spinæ?*

To hold the spinal column erect.

90. *What are the causes of the great flexibility of the Spinal Column in snakes?*

First, there are a great number of vertebræ so as to divide up the motion, the rattlesnake having over 200 and the boa constrictor 304 vertebræ. Secondly, there is a ball-and-socket joint between all the vertebræ.

91. *What muscle opens and what closes the eyes?*

Levator Palpebræ opens, and Orbicularis Oculi closes them.

92. *What muscles move the eyeball?*

Recti (four in number).

93. *Define Annular Ligaments.*

Bundles of ligaments passing around the wrist and ankle, like bracelets, to keep the tendons in place.

94. *Describe the process of contraction in a muscle.*

The fibers all shorten themselves, and the muscle swells out or becomes thicker, as does a piece of india-rubber

95. *What two kinds of contraction in muscles?*

(1) From their own elasticity; (2) from stimulation through the nerves.

96. *Give an illustration of the first kind of contraction.*

When a muscle is cut in two by accident, the two cut ends separate because they are drawn apart by the contraction of the fibers.

97. *What is the cause of Squinting?*

Permanent contraction of a muscle on one side of the eye, causing it to pull more strongly than the one on the opposite side.

98. *What kind of muscle is employed when the horse shakes its skin to remove dust or flies?*

Tegumentary muscle, which is a thin layer of fibers lying just beneath the skin. It is only rudimentary in man.

99. *What is St. Vitus's Dance?*

A disease of the voluntary muscles, in which they are in spasmodic or irregular motions which can not be controlled by the will.

100. *What are Convulsions?*

Involuntary contractions of the muscles.

101. *What is Locked-Jaw?*

It is a disease characterized by spasms and contractions of the voluntary muscles, and usually begins with the stiffening of the lower jaw—hence the name.

102. *What parts are mainly affected in Rheumatism?*

The connective, white, fibrous tissues of the larger joints.

103. *What is Lumbago?*

A rheumatic pain in the muscles of the small of the back.

104. *What is the effect of exercise upon a muscle?*

It receives more blood, and becomes larger, harder, and darker colored.

105. *Where is the "white meat" in a fowl found?*

In that part where the muscles are least used in flying or running.

106. *Is it correct to say that exercise will lead to the proper development and health of the muscles?*

No; exercise and rest are both necessary. Violent and long-continued exercise is more hurtful than inaction.

107. *State some of the Rules for Exercise.*

The muscles need use; their use should be followed by rest; feats of strength and endurance are harmful; exercise should be regular, and is better in the open air; heavy gymnastics should be avoided by students and persons of sedentary habits. Isocrates said: "Exercise for health, not for strength."

## THE SKIN.

1. *Of what is the Skin composed?*

   Of two layers, the epidermis or cuticle, and the derma or cutis.

2. *Describe the Cuticle.*

   It is the outer skin, and is only the covering of the true skin. It neither bleeds when cut, nor is sensible to pain, heat, or cold

3. *Give the different names for the Outer Skin.*

   Cuticle (*cuticula*, little skin); Epidermis (*epi*, upon, and *derma*, skin); Scarf-skin.

4. *Describe the Derma.*

   It is the lower layer, and is the true skin It is composed of fibrous tissue, and is abundantly supplied with blood vessels, nerves, and lymphatics.

5. *Give the different names for the Inner Skin.*

   Cutis, Cutis Vera (true skin), and Derma.

6. *Where is the Cuticle thickest?*

   On the soles, palms, and other places needing a strong protection.

7. *Give illustrations of the insensibility to pain of the Cuticle.*

   In shaving the skin may be cut without blood or pain unless the razor goes below the cuticle. Pins may be run through the thick mass of skin near the thumb-nail without pain. Strong brine will not cause smarting unless there is a scratch in the skin.

8. *What is Scurf or Dandruff?*

   The cuticle is composed of small scales, which are thrown off as scurf, dandruff, etc.

9. *What purpose does the Cuticle serve?*

   It serves as a protection to the parts it envelops, being thick where pressure and hard usage have to be provided for.

10. *Where is the Cuticle thinnest?*

Where there is a necessity for rapid motion, as in the eyelids.

11 *The difference of hue between the blonde and the brunette, the American and African, is due to what?*

The difference in the pigment or coloring-matter in the freshly-made cells on the lower side of the cuticle.

12. *Why are scars often white?*

Because the pigment cells are not restored.

13. *How large are the grains of the Pigment?*

They are very small; only about two-thousandth part of an inch in diameter.

14. *How large are the scales of which the Cuticle is composed?*

"In one square inch of the cuticle, counting only those in a single layer, there are over a billion horny scales, each complete in itself."

15. *What are Freckles?*

The pigmentary matter of the cuticle gathered into spots

16. *What is the effect of sunlight on the coloring-matter in the skin?*

Sunlight and a high temperature combined seem to increase the pigmentary matter, and to darken the skin.

17. *How is the Cuticle changed in man and in the snake?*

The snake throws off the cuticle entire at regular intervals; in man the change is constantly going on by the shedding of little scales from the surface.

18 *What change takes place in the shape of the Epidermoid Scales?*

When first formed they are spherical cells; as they pass to the outer surface they become flattened.

19 *How is the Derma, or True Skin, sometimes divided?*

Into two layers, called the Papillary or basement layer, and the Corium. The latter is the lower one.

20. *Name the three Membranes of the Skin.*

Epidermis, Basement membrane, and Corium.

21. *What are the Papillæ?*

They are protuberances which roughen the skin, and are supplied with one or more loops of nerves.

22. *Where are the Papillæ most abundant?*
Upon the palms and soles.

23. *What is the Corium?*
It is the innermost layer, and possesses vitality and sensibility, and contains all the vessels of the skin.

24. *What is a Gland?*
It is a secreting organ made up of small bodies of minute proportions, each of which contains an artery, a vein, and a duct.

25. *What do Glands secrete?*
They secrete in their cells some liquid from the blood.

26 *What is the Physiological name of the Sweat Glands?*
Sudoriparous Glands.

27. *What are the Pores of the Skin?*
The outlets of the ducts or tubes of the sweat glands.

28. *What is the size of the Sweat Glands and their Ducts?*
The glands are about one-seventieth of an inch in diameter; their tubes or ducts about one four-hundredth of an inch in diameter, and when straightened out about one-tenth of an inch in length.

29 *What can you say as to the number of Sweat Glands?*
By actual count there are at least 2,800 in every square inch of the skin, which would make 7,000,000 in the whole body. The combined length of these tubes would amount to about ten miles.

30. *Define Perspiration.*
A transparent liquid poured out by the sudoriparous glands, and is of an acid reaction and salty taste.

31. *What proportion of the Perspiration is solid matter?*
About one per cent.

32. *What two kinds of Perspiration?*
Sensible and Insensible.

33. *What is the average amount of Perspiration in an adult?*
About two pounds per day.

34. *What would be the effect of stopping all Perspiration?*
Death in a short time.

35. *What are the Sebaceous Glands?*
Oil glands or little sacs which secrete an oil that flows

through their ducts to the roots of the hair, and thence oozes out on the cuticle.

36. *What is the office of the Oil Glands?*
To lubricate the hair, and keep the skin in a flexible condition.

37. *What are the Ear Glands?*
Sebaceous or oil glands, but they secrete a waxy matter.

38. *Give illustrations of the power of Absorbtion in the skin.*
Contagious diseases are contracted by touching; painters' colic is caused by the absorbing of lead through the skin; the lizard, after being deprived of water, will increase in weight if any part of its body is placed in water.

39. *In what way do the Sweat Glands possess the advantages of Valves?*
They open in an oblique direction, and thus act as valvular openings, preventing the ingress of dust and injurious solid substances.

40. *Why do Physiologists usually treat of the Hair under the head of "The Skin?"*
Because the hair is properly an appendage of the skin, the roots of the hair not extending below the skin. In animals covered with short hair it is evident that their hairy coat and skin should be treated together.

41. *In what system may the Skin, Hair, and some other substances in man and the lower animals be placed?*
The Tegumentary System, which includes the skin, hair, nails, claws, scales, and horns, as all these are modified forms of the cuticle.

42. *What can you say of the so-called Horn of the Rhinoceros?*
It is nothing but a thickening of the epidermis until it assumes the form of a hollow cone.

43. *What fur-coated animals have Epidermic Scales on their Tails?*
The beaver and some others.

44. *What are the Follicles of the Hair?*
Little sacs of flask shape in the scalp in which the hairs originate.

45. *Of what two parts does a hair consist?*
The outer or cortical, and the inner or medullary.

46. *How does the Hair grow?*
By constant prolongation from the follicle, and not by addition to the ends.

47. *If a notch or permanent mark be made on a hair one inch from its outer end, will it remain the same distance from the end as the hair grows in length?*

It will; and hair artificially colored will show its natural color as it grows, next to the scalp.

48. *How many hairs on a human head, with a thick growth of hair?*

About 100,000. Between 700 and 800 have been counted on a square inch.

49. *What is said of the strength and elasticity of the Hair?*

It is very strong and elastic. A single hair has supported a weight of two ounces, but this strength is exceptional. A hair may sometimes be stretched nearly one-third its length without breaking.

50. *When a hair is pulled out by the roots will it grow again?*

It may, unless its follicle or papilla is destroyed. If this is done it will never grow again.

51. *What is the cause of hair turning gray?*

It is entirely unknown, and no remedy for it has yet been discovered.

52. *What is to be said of hair dyes?*

They almost always depend for their action, on lead or lunar caustic, and are injurious to the scalp and the whole system.

53. *What is the cause of Hair standing on end?*

There are tiny muscles found among the fibers of the scalp which contract through the influence of fear, cold, or electricity.

54. *What causes the unpleasant odor arising from burning Hair?*

The hair contains more sulphur than most other parts of the body, viz.: about ten per cent. Sulphur and nitrogen give rise to the unpleasant odor in burning.

55. *Are the tissues of the Hair easily destroyed?*

No; next to the bones and teeth, hair is the least destructible part of the body.

56. *What is said of the sudden whitening of the Hair?*

There are undoubted cases of the hair turning white in a single night from fright, grief, or nervous excitement.

57. *What useful purpose does the Hair serve?*

It is a protection from heat and cold, and shields the head from blows.

58. *What useful purposes do the Nails serve?*

They protect the ends of the fingers and toes, and enable us more easily to pick up and firmly grasp objects.

59. *What is the Matrix of the Nail?*

The groove or bed in which it is set.

60. *How do Nails grow?*

From their roots, just as hairs do.

61. *If a notch be made in the outer end of a Nail, will it grow over?*

No; the nail grows from the other end, and the notch will only be carried out further from the end of the finger.

62. *What is said of the rate of growth of Nails?*

"The thumb nail is said to occupy about twenty weeks in growing from the root to the extremity; that of the great toe about two years—an estimate which is probably too long."—*J. W. Draper.*

63. *How rapidly does the Hair grow?*

In one set of experiments the hair was found to grow one-half an inch per month. It grows faster by day than by night, and in summer than in winter.

64. *To what is the color of the Hair due?*

It is thought by some to be owing to the iron it contains, and it is said that there is most of this metal in black hair.

65. *What is the Pigmentum Nigrum?*

It is the coloring matter of the eye, and means black paint.

66. *Has the Cuticle any vitality?*

No; it is merely a layer of Albumen.

67. *What is the Mucous Membrane?*

A thin tissue or skin covering the open cavities of the body.

68. *What is Mucus?*

A fluid secreted by a membrane, and serving to lubricate it.

69. *What is the distinction between the Mucous and the Serous Membrane?*

The Serous Membrane lines the cavities of the body not open to the external air.

70. *What is Serum?*

The thin part of the blood.

71 *What is the red covering of the lips?*

It does not seem to be either skin or mucous membrane, but a texture intermediate between them.

72. *Where is the Mucous Membrane found?*

It begins in the mouth and nose, and lines all the passages to the lungs, the stomach, and other organs.

73. *Where is the Serous Membrane found?*

It lines the inside walls of the great cavities of the body, as of the chest and abdomen. It also lines the outside of the great internal organs of the body, such as the lungs and intestines.

74. *What is Connective Tissue?*

It is the tissue or fibers of which the lower layer of the skin (the cutis) and the corresponding layer of the mucous and serous membranes are composed.

75. *Why is it so called?*

Because it spreads from the cutis into the mucous membrane, and invests muscles, bones, and cartilages. Thus it connects all parts of the body.

76. *When butchers blow air into veal to make it appear plump, what tissue is distended?*

Connective tissue.

77. *What branch of medicine treats of the Skin and its diseases?*

Dermatology.

78. *Name some common disorders of the Skin and its appendages.*

Erysipelas, chilblain, wens, dropsy, corns, warts, and ingrowing nails.

79. *What is Erysipelas?*

An inflammation of the skin, attended with fever and redness; sometimes called St. Anthony's fire.

80. *How does it often begin?*

With a little red spot on the forehead, and spreads rapidly.

81. *What is its cause?*

The real cause is as yet unknown.

82. *Is it contagious?*

The disease appears most certainly to be transmissible by contagion, also through the air; there seem also to be cases where the disease starts without connection with any previous case.—*Bulkley.*

83. *What is Dropsy?*

A morbid collection of water into any of the cavities, and follows many chronic diseases.

84. *Where are Corns sometimes found besides on the feet?*

On the shoemaker's knee and the soldier's shoulder.

85. *What is a Corn?*

A thickening of the cuticle, caused by friction or pressure.

86. *How may Corns be removed?*

Soaking with hot water or a poultice over night will soften the part, and admit of its being dug or picked out with little pain. First, however, secure a properly fitting shoe.

87 *What is a Wart?*

An overgrown papillæ, with more or less epidermal accumulation.

88 *What capricious characteristics have Warts?*

They often appear suddenly and disappear spontaneously; but they are never charmed away.

89. *What is a Wen?*

An indolent tumor without inflammation; sometimes a hard excrescence of the skin.

90. *What is the effect of bathing?*

It removes effete matter, and opens the pores of the skin; it stimulates the skin, and quickens its healthy action.

91. *What is meant by the reaction after bathing?*

After the surface is slightly chilled by a cold bath the blood is excited to more vigorous action upon the skin, and reddens, warms, and stimulates it, causing a pleasant glow of warmth.

92. *Give the temperature of three kinds of baths?*

In the tepid bath the water ranges from 85 to 92 degrees; in the warm bath from 92 to 98; in the hot bath from 98 to 112.

93. *Is a shower bath of cold water to be recommended?*

It may be beneficial to the strong and healthy, but is too severe a shock for the delicate.

94. *What is the effect of friction on the skin?*

Frequent and thorough dry friction applied to the skin greatly promotes its health. A daily rubbing of the body is recommended.

95. *How is the temperature of the body kept down when the atmosphere is warmer than blood heat?*

Chiefly by the evaporation from the skin, carrying off large quantities of heat.

96. *Why do savages in cold climates cover their bodies with oil?*

The oil, by diminishing the evaporation, assists in keeping them warm.

97. *Why should clothing worn next to the skin be frequently changed?*

To allow it to dry, so as to absorb the perspiration, and to keep it from being filled with the effete matter from the body. Clean underclothing, by its friction against the skin, gives it a stimulus and healthy action.

98. *When the skin is accidentally burned, so as to raise the cuticle in a blister, what is the great secret of preventing pain?*

To relieve the burning pain, it is necessary to exclude the burned part from the air by some simple dressing, such as a sticking plaster. Keep the injury clean and quiet, to enable the skin to renew itself.

99. *What is the effect of sunlight on the skin?*

The strong light of the sun in the fresh air gives a strength, vigor, and healthy color to the skin that can be acquired in no other way. Sleeping rooms should receive the direct light of the sun during a portion of the day.

100. *What is a Cold?*

It is usually a congestion and inflammation of some internal membrane. The cause affects the skin so that the blood current through it is chilled, and the blood is sent in undue quantities to the delicate surfaces within.

## THE DIGESTIVE SYSTEM.

1. *Name the Digestive Organs.*

   The mouth, teeth, salivary glands, palate, pharynx, œsophagus, stomach, intestines, liver, pancreas, and spleen.

2. *Describe the Palate.*

   The palate is the roof of the mouth, and consists of two parts, the soft palate in the back part of the mouth, and the hard palate, which lies between the upper teeth.

3. *What is the lower part of the Mouth called?*

   The floor of the mouth, and is included within the lower teeth.

4. *What digestive organs does the Mouth contain?*

   The teeth, salivary glands, and other small glands and follicles situated upon the floor and back parts.

5. *What are the Tonsils?*

   They are simply aggregations of follicles, situated in the upper part of the throat. Their use is not clearly understood.

6. *How many Teeth are there?*

   Thirty-two in all, or eight in each half-jaw, similarly shaped and arranged.

7. *What is the marked characteristic of the Teeth?*

   Their hardness; the teeth are the hardest substance in the body.

8. *What is the enamel of the Teeth?*

   A thick coat covering the body of the tooth down to the gum, and giving it its hardness.

9. *Is the enamel chiefly animal or mineral matter?*

   It is nearly all mineral; only two and one-half per cent. is animal matter.

10. *Describe the interior of the Tooth.*

It consists chiefly of a substance resembling bone, and called *dentine*. In the center is the nerve cavity.

11. *What is the crown of a Tooth? the root? the neck?*

The crown is the part protruding above the gum, and covered with enamel; the root or fang is the part contained in the socket of the jaw; the neck is the slightly contracted ring grasped by the gum.

12. *Is any part of a Tooth true bone?*

Yes; the covering of the fang is true bone.

13. *Does the fang of a tooth touch any part of the jaw-bone?*

No; the fang is lined with a membrane which when in a healthy state deadens the force of any shock, but when inflamed becomes the seat of excruciating pain.

14. *What two kinds of toothache are there?*

One kind is caused by the irritation of the substance filling the cavity of a tooth; the other by the inflammation or ulceration of the membrane lining the root.

15. *Describe the substance found in the cavity of the teeth.*

It is a pulpy substance of a reddish white color, and full of nerves and blood-vessels; it is exceedingly sensitive.

16. *What are the Milk Teeth?*

They are our first teeth, and are only twenty in number.

17. *At what age do the Permanent Teeth appear?*

The central incisors at about the age of seven years; the first bicuspids at nine, the second at ten; the canines at eleven or twelve; the second molars at thirteen, and the last or wisdom teeth at twenty-two or later.

18. *Give the number of each kind of teeth.*

There are four incisors, two canines, four bicuspids, and six molars (sixteen in all) in each jaw

19. *What is the great difference in the arrangement of the teeth of carnivorous and herbivorous animals?*

In flesh-eating animals the front teeth are tearing ones, and the back teeth have sharp edges for cutting. In herbivorous animals there are no tearing teeth, but cutting ones in front, and grinding ones back.

20. *What may be said of the teeth of man with reference to cutting, tearing, and grinding?*

Man has all three kinds of teeth; the incisors are cutting teeth, the molors grinding, and the canines tearing. It is to be observed, however, that his molors are not as thorough grinders as those of the horse or cow, and his canines are not such long and powerful tearing teeth as those of the dog.

21. *What is the Alveolar Process?*

Process, in anatomy, is an eminence or projection; the alveolar process is the bony structure by means of which the teeth are attached to the jaw. The attachment is strengthened by the fibrous, fleshy structure of the gums.

22. *What becomes of the bony process after the extraction of a permanent tooth?*

It is absorbed, leaving the jaw-bone covered only by the lining membrane of the gum.

23. *How many roots or fangs have the teeth?*

The molars of the upper jaw have three each, the molars of the lower jaw two, and the incisors, cuspids, and bicuspids one each.

24. *Describe the Salivary Glands.*

They are three pair of glands with ducts opening into the mouth for the purpose of secreting a fluid to keep the mouth moist, and to moisten food as it is chewed. They are called the Parotid, the Submaxillary, and the Sublingual gland.

25. *Describe the Parotid Gland.*

It is the largest of the salivary glands, and is situated just under the ear, and behind the angle of the jaw; a duct called Steno's from this gland opens into the mouth opposite the second molar tooth of the upper jaw.

26. *Where is the Submaxillary Gland?*

It is situated within the lower jaw, and its duct opens into the mouth at the side of the tongue.

27. *Where is the Sublingual Gland?*

It is in the floor of the mouth, and has seven or eight small ducts opening into the mouth.

28. *What gland is swollen in the "Mumps?"*

The Parotid.

29. *What amount of Saliva is secreted daily?*

From three to six pounds by an adult in good health.

30. *What is Ptyalin?*

A peculiar organic substance contained in the saliva which changes the starch of masticated food into glucose, or grape sugar.

31. *What is the Œsophagus?*

A large membranous tube extending from the throat to the stomach. It is a part of the alimentary canal.

32. *What is the Pharynx?*

It is the part of the alimentary canal in the throat, and is a funnel-shaped cavity about four inches long, extending from the mouth to a point behind the Adam's apple.

33. *How many passages has the Pharynx?*

Four; one leading upward and forward to the nose; the second, forward to the mouth; the third, downward to the lungs; and the fourth, downward and backward to the stomach.

34. *Describe the muscular fibers of the Pharynx.*

The pharynx is made up of muscular fibers, which run in two directions, and cross each other at a large angle, so as to give great compression upon the food as it is swallowed.

35. *Describe the size and shape of the Stomach.*

It has been called pear-shaped, and has also been compared to a bag-pipe. It is about twelve inches long and four inches in diameter, and holds about three pints.

36. *What two membranes line the Stomach?*

The inner lining is the mucuous membrane, which secretes digestive fluids; the outer lining is the serous membrane, which is well lubricated. Between these two membranes is a stout muscular coat.

37. *Describe accurately the location of the Stomach.*

It is situated in the upper portion of the left side of the abdomen, immediately beneath the diaphragm, and inclines obliquely downward from left to right.

38. *What is said of the dilation or distention of the Stomach?*

Long-continued gormandizing or excessive drinking of vinous and malt liquors will distend the stomach to three or four times its normal size. The normal stomach will

hold something less than a quart; the stomachs of enormous eaters have been found after their death to hold a gallon.

39. *How many openings has the Stomach?*

Two: the cardiac, which is connected with the œsophagus, and the pyloric, which is connected with the intestines.

40. *What is the structure of the Intestines?*

Similar to that of the stomach; they are formed of the mucous and the serous membranes, with a muscular coat between.

41. *What two divisions are there of the Intestines?*

The small intestines and the large intestines; the former open into the stomach.

42. *Give the physiological names of the different parts of the Intestines.*

(1) Duodenum, (2) Jejunum, (3) Ilium, (4) Cæcum, (5) Vermiform Appendage, (6) Colon, (7) Rectum.

43. *What part of the Intestines is sometimes called the Second Stomach?*

The Duodenum.

44. *Describe the Duodenum.*

It is the first division of the intestines, and is called the duodenum (twelve) because its length is of the breadth of twelve fingers, or about ten inches. It commences with the pyloric orifice on the right extremity of the stomach, and runs slightly backwards and upwards until it terminates in the Jejunum.

45. *Describe the Jejunum.*

It is the intestine next below the duodenum. Its name means "empty," and it is so called because it is always found in this condition after death.

46. *Describe the Ilium.*

It is the third division of the intestines; it is the smallest of the intestines, and is about fifteen feet in length It is named from a Greek word meaning "to twist," and is so called on account of its tortuous course.

47. *Describe the Cæcum.*

It is the fourth division of the intestines, and is a short sac not exceeding four inches in length, but of a larger diameter than the small intestines.

48 *Describe the Vermiform Appendage.*

It is a small part of the intestines attached to the cæcum, and is so named because it is shaped like a worm. It is not known that it serves any useful purpose in man, but it is largely developed and of great service in some of the lower animals.

49. *Describe the Colon.*

It is that division of the intestines which on the right side of the body passes upward, then crosses horizontally to the left side of the body, and then passes downward. It is from five to eight feet long

50. *What is to be said of the length of the Intestines?*

The aggregate length of the intestines in man is about thirty feet; in herbivorous animals it is much greater, amounting in a full grown ox to 150 feet.

51. *Name the large and the small Intestines.*

The large intestines are the Cæcum, the Colon, and the Rectum; the small intestines are the Duodenum, the Jejunum, and the Ilium.

52. *What is the Liver?*

The liver is a gland; it is the largest of the glands; it is of a reddish-yellow color, and its chief purpose is to secrete bile.

53. *Where is the Liver situated?*

On the right side of the abdomen, below the diaphragm. Its situation is on the right side of the body, corresponding to that of the stomach on the left side.

54. *How large is the Liver?*

Excepting the brain, it is the largest organ in the body. It measures about a foot in its longest diameter, and weighs on the average four pounds.

55. *How is the Liver divided?*

Into five lobes or great divisions, and each of these is composed of minute divisions or lobules about the size of a millet seed. Each of these lobules contains an artery, a vein, and a network of ducts.

56. *What is the Bile?*

It is a fluid of a dark green color and bitter taste, secreted by the liver. It acts upon the food in some way not fully understood. When not needed in digestion, the bile is

stored away in the gall bladder, which is under the right side of the liver.

57 *What is the Pancreas?*

The Pancreas is a gland about six inches in length, situated behind the stomach.

58. *What is the Pancreatic Fluid?*

A liquid secreted by the pancreas at the rate of from five to seven ounces per day. It closely resembles saliva, and in the process of digestion produces important chemical changes in the food.

59. *What is the Alimentary Canal?*

It is the canal or passage for the food in the process of digestion; it commences with the mouth, and includes the pharynx, œsophagus, stomach, and the whole length of the intestines.

60. *Give the principal steps in the process of digestion.*

(1) Mastication and Insalivation in the mouth. (2) Deglutition or swallowing. (3) Passage of the food through the œsophagus into the stomach. (4) Gastric digestion in the stomach. (5) Intestinal digestion. (6) Absorbtion into the blood.

61. *What change takes place in the lining of the stomach on the admission of food?*

As soon as food enters the stomach the blood-vessels of the membranous inner lining are filled, the membrane becomes of a bright red color, and the gastric juice is rapidly secreted.

62. *How much Gastric Juice is secreted in a day?*

It is variously estimated to be from five to thirty-seven pounds per day.

63. *How is the food moved about in the stomach?*

The stomach carries the food from right to left, and then in the reverse direction, a revolution being completed in about three minutes.

64. *What is Pepsin?*

A peculiar organic substance found in the gastric juice, and is one of the most important aids to digestion. It constitutes about two-thirds of the gastric fluid, and acts as a ferment on the food.

65. *How is Pepsin as an article of commerce obtained?*

From the stomachs of animals. Pigs or calves are excited by savory food, which they are not allowed to eat, and then at once killed.

66. *Is Digestion a chemical action?*

It is believed to be mainly so, since it has been found possible to have meat digested in a bottle, though much more slowly than in the stomach.

67. *What is meant by the expression, "The Chemico-Vital Process of Digestion?"*

It means that digestion is partly a chemical and partly a vital process. In so far as digestion depends upon vital power it is beyond our comprehension.

68. *What is Chyme?*

It is the name given to that state of food after it is thoroughly dissolved and acted upon by the stomach.

69. *What is Chyle?*

It is a milky fluid formed from chyme in the duodenum by the action of the pancreatic juice and the bile.

70. *How does the food pass from the Stomach?*

When all the food is dissolved into the liquid condition called chyme, it passes through the pyloric orifice into the duodenum.

71. *What change does the food undergo in the Duodenum?*

Intestinal digestion is there commenced by the secretions of the liver and pancreas, and the chyme becomes chyle.

72. *What is Trypsin?*

A ferment found in the pancreatic fluid which performs an important work in changing chyme into chyle.

73. *Where does the Chyle pass?*

From the large intestines into the small intestines.

74. *Does the Chyle pass directly from the small intestines to the heart?*

No; it is first carried to the liver, where some important change not fully understood is again made, when it is poured as blood into the heart.

75. *What is the Portal Vein?*

It is the vein which carries to the liver the food absorbed by the veins of the stomach and intestines.

76. *What are the Lacteals?*

Small tubes or vessels for carrying chyle from the intestines to the thoracic duct.

77. *Define Digestion.*

It is the process by which food is prepared to become the nutrient part of the blood

78. *Why should food be thoroughly masticated?*

The more thoroughly it is ground up the more readily it is acted upon by the digestive fluids.

79. *Why do grains of wheat after being chewed become of a sweetish taste?*

They become mixed with saliva, which changes the starch of the wheat into sugar.

80. *Why does much water or other liquid taken at meals retard digestion?*

Because it dilutes the saliva and other digestive fluids, and weakens their chemical action.

81. *How long a time is requisite for the digestion of a full meal?*

It varies with the kind of food and the condition of the system from one to four hours.

82. *How much daily food does a man in health need?*

About two and one-quarter pounds of food and three pints of drink.

83. *What three purposes does food serve?*

(1) To supply the material for the growth of the body. (2) To maintain its warmth. (3) To repair the waste of the tissues.

84. *What two common articles of man's sustenance are wholly inorganic?*

Water and common salt. Other inorganic matter, such as iron, sulphur, magnesia, lime, phosphorus, and potash, are found in water and animal and vegetable foods.

85. *What purpose does salt serve in the animal economy?*

It is necessary to the secretion of some of the digestive fluids, and to aid in working off from the system its waste products.

86. *How much of the body is water?*

About two-thirds; in a man weighing 154 pounds there are 100 pounds of water, or about 12 gallons.

87. *Where are iron, lime, phosphorus, and sulphur found in the body?*

Iron in the discs of the blood; lime in the bones and teeth; phosphorus in the brain, and sulphur in the hair. Most of these minerals are also found in various other parts of the body in small quantities.

88. *What two kinds of organic food are there?*

(1) Nitrogenous, (2) Carbonaceous. The latter is subdivided into Sugars and Fats.

89. *What foods contain most Nitrogen?*

The whites of eggs, cheese, lean meat, and wheat bread. These substances contain much albumen, which is chiefly nitrogenous.

90. *What is meant by Carbonaceous food?*

Foods which contain much carbon, such as sugars and fats; they are the chief heat-producing foods.

91. *From what substances may the Fats be obtained?*

Fat meat, butter, oily grains and seeds, and the kernels of seeds. Lard, olive oil, and cotton-seed oil are extensively used in cooking, and are fats.

92. *Where is a large quantity of the Fats necessary?*

In the long winters of the Arctic regions fatty food is absolutely necessary to sustain life.

93. *What foods contain the Sugars in largest proportions?*

Corn, rice, potatoes, and ripe fruits. The sugars include glucose, gum, and starch.

94. *What kind of food should predominate in each of the Zones?*

"Fatty foods serve best for a frigid climate, grains for the temperate, and ripe fruits for torrid latitudes."—*Eclectic Physiology.*

95. *What truth is there in the popular saying that the body changes every seven years?*

It is generally admitted by physiologists that the whole body is renewed in the course of a few years, although the precise number can not be stated, since many circumstances modify the change, such as exercise and climate. A period of from seven to ten years is probably sufficient to complete the change.

96 *What organs are constantly at work removing the waste particles?*

The lymphatics, which are found in every part of the body in great numbers.

97. *What is the effect of cooking?*

It is intended to serve one or more of three purposes: (1) To render food more digestible; (2) to make it more palatable; (3) to destroy any germs of disease that may be in the food.

98. *Why is thorough cooking of pork especially important?*

Pork sometimes contains a parasite called trichina, which, in the human system, often produces a fatal disease Thorough cooking is the only sure method of destroying this parasite

99. *What is Caffeine?*

It is the peculiar principle found in coffee to which the stimulating effects of the drink are due.

100. *What is to be said of the use of Coffee?*

"Taken in moderation, it clears the intellect, tranquilizes the nerves, and usually leaves no unpleasant reaction." In youth, however, it is not so needful as in later years.

101. *Is Coffee a true food?*

It is probably not a true food, but retards the waste of the tissues, and is thus a kind of negative food.

102. *What is Theine?*

It is the active principle of tea When used moderately its effects are similar to those of coffee.

103 *What is the active principle of Chocolate called?*

Theobromine; it has some of the properties of caffeine and theine.

104. *What arrangement for grinding food in place of teeth have grain and seed-eating Birds?*

A gizzard in the stomach, which has two hard surfaces, which, when rubbed and pressed together, grind and break up the food Flesh-eating birds have no gizzard.

105. *State the great distinction between the stomachs of Carnivorous and Herbivorous Animals.*

Flesh-eating animals, such as the lion, have only a single stomach; herb-eating animals, such as the cow, have four stomachs.

106. *What is the reason of this difference?*

Vegetable food is more unlike the body of the animal eating it than flesh, and it requires a more complicated apparatus to change it into nutrient blood.

107. *Why does not the stomach digest itself?*

The gastric juice does not digest living matter. After death the stomach is acted upon by the digestive fluids, and its walls are sometimes eaten through.

108. *Define Hunger.*

It is the sensation of a want of nutriment manifested by impressions on the nerves of the stomach.

109. *Define Thirst.*

It is the sensation of a want of liquids in the system, and is manifested in the fauces or throat.

110. *What is the origin of the name of the Spleen?*

It is so named because the ancients supposed it to be the seat of melancholy. Spleen is a Greek word, meaning ill-temper or peevishness.

111. *What is the Spleen?*

It is an oblong, flattened organ of a dark-bluish color, situated on the left side, in contact with the diaphragm, stomach, and pancreas. It has no outlet.

112 *What is the office of the Spleen?*

It is not certainly known what function it performs.

113. *Give the seven different processes through which food passes to form living matter.*

Mastication, insalivation, deglutition, chymification, chylification, absorption, and assimilation

114. *Why is it that actors, night editors, and others whose brains are worked late at night, can sleep best after eating moderately before going to bed?*

The food in the stomach for its digestion draws the blood from the excited brain to the stomach, and thus prevents wakefulness.

## THE CIRCULATORY SYSTEM.

1. *Name the organs of the Circulatory System.*

   The heart, the arteries, the veins, and the capillaries, all of which, except the heart, are tubes of various dimensions.

2. *Where is the Heart situated?*

   In the thorax, or chest, somewhat to the left of the middle line of the body, and has its lower surface resting on the diaphragm.

3. *What is the Heart?*

   It is the central organ, or engine, of the circulation, and forces the blood through long tubes to every part of the body; it is of conical form, and made of muscular fiber.

4. *What is said of the arrangement of the fibers of the Heart?*

   They cross each other in at least three directions, and many of them "anastomose"—that is, join each other in several different places.

5. *What are the Arteries?*

   They are tough cylindrical tubes, which convey the blood from the heart to the different parts of the body.

6. *What are the Veins?*

   They are the tubes which carry the blood from the different parts of the body to the heart.

7. *What is the Blood?*

   It is the circulating fluid of the body, and contains all the materials for the support of every part of the animal fabric.

8. *Of what does the Blood consist?*

   When examined with a microscope it is found to consist of a transparent liquid and minute circular bodies called corpuscles floating in the liquid.

9. *What different names are given to the liquid portion of the Blood?*

   Plasma, Serum, and Liquor Sanguinis.

10. *Describe the Blood Corpuscles.*

They are exceedingly minute, flattened discs, with both surfaces slightly concave.

11. *What two kinds of Blood Corpuscles are there?*

The red and the white; the former give the blood its color. The white corpuscles are few in number compared with the red.

12. *What is meant by the Coagulation of the Blood?*

It is the formation of the thickened mass called the "clot" when the blood is exposed to the air. The thickened part of the blood is composed of its corpuscles and fibrin.

13. *What useful purpose does the Clotting of the Blood serve?*

It checks and stops ordinary cases of bleeding; the thickened mass forms a plug to the wound, and thus often preserves life.

14. *What is the Pericardium?*

It is a loose sac of serous membrane enclosing the heart.

15. *What movements has the Heart?*

Two: Alternate contraction and expansion; the former is called the systole, and expels the blood; the latter the diastole, and receives the blood.

16. *Is the Heart attached to any part of the body?*

It is everywhere free or unattached, except at its base, which, by the means of large blood vessels, is attached to the vertebral column.

17. *In what sense is the Heart a double organ?*

One side is called the arterial and the other venous, or left and right hearts; the former receives and propels pure or arterial blood, and the latter circulates venous blood.

18. *How many chambers in the Heart?*

Four: Two auricles, and two ventricles.

19. *What are the Auricles?*

Reservoirs for receiving the blood. The left auricle receives bright and pure blood from the lungs; the right one receives the dark and foul blood after it has made the tour of the body.

20. *What are the Ventricles?*

They are the cavities or chambers from which the blood is forced outward.

21. *Where does the blood go from the Left Ventricle?*

Into the large tube called the aorta, which leads to all parts of the body.

22. *Where does the blood go from the Right Ventricle?*

Into a large tube called the pulmonary artery, leading to the lungs.

23. *Is there any vein or artery between the left and right divisions of the heart?*

No; they are separated by an impassable wall, so that there is no communication between them.

24. *What names are sometimes given to the right and left divisions of the Heart?*

The right division is sometimes called the pulmonic heart, and the left the systemic heart.

25. *What is the fluid capacity of the Heart?*

It ordinarily contains about one pint of blood.

26. *How much Blood is there usually in the system?*

The average quantity in a healthy man is about eight quarts, or something less than twenty pounds. Foster places it at about one-thirteenth of the weight of the body.

27. *What are the Valves of the Heart?*

They are peculiar forms of muscular and tendonous fibers, making a kind of a curtain, which will allow the blood to flow in one direction, but not in the opposite direction.

28. *What different kinds of Valves in the Heart?*

Three: The tricuspid, the bicuspid, and the semi-lunar.

29. *Where is the Tricuspid Valve?*

At the opening of the right ventricle. It consists of three folds or flaps of membrane.

30. *Where is the Bicuspid Valve?*

In the left ventricle.

31. *What are the Semi-lunar Valves?*

They are three valves of a half-moon shape in the passages outward from the ventricles.

32. *When and by whom was the circulation of the blood discovered?*

The discovery is usually attributed to Dr. William Harvey, an English physician, who first published his discovery to the world in 1628.

33. *What is the Pulse?*

It is the expansion of the radial artery in the wrist by each wave of blood set in motion by the contraction of the heart.

34. *How rapidly does the Pulse beat in health?*

On the average about seventy-two times per minute; it varies even in healthy persons from forty to one hundred.

35. *How rapidly does the blood circulate?*

It is estimated that some of the blood makes the tour of the whole body in about twenty-three seconds, and that the entire mass passes through the heart in from one to two minutes.

36. *What forces propel the blood through the system?*

(1) The contraction of the heart. (2) Elasticity of the arteries. (3) Capillary force. (4) Muscular pressure. (5) Act of inspiration. (6) Arterialization of the blood.

37. *What is the difference in the kind of blood conveyed by arteries and veins?*

The arteries convey pure blood, called also arterial; the veins convey dark or impure blood, called also venous.

38. *What arteries convey venous blood, and what veins convey arterial blood?*

The pulmonary arteries carry venous blood to the lungs, and the pulmonary veins convey arterial blood from the lungs.

39. *What is the Pulmonic Circulation?*

It is the circulation from the right ventricle through the pulmonic artery to the lungs, and back to the left auricle through the pulmonic veins.

40. *What is the Systemic Circulation?*

It is the circulation through the system by means of the aorta and the arteries and their returning veins.

41. *What other names are given to these two circulations?*

The pulmonic is called the Lesser Circulation, and the systemic is called the Greater Circulation.

42. *What is the Aorta?*

The largest artery in the systemic circulation; it passes upward from the heart at first, describes a curve, and goes downward along the spinal column. The curved portion

is called the arch of the aorta; between the arch and the diaphragm it is called the thoracic aorta; below the diaphragm, the abdominal aorta.

43. *What are the Carotids?*

Arteries carrying the blood upward along the neck.

44. *What are the Subclavians?*

Arteries carrying blood to the arms.

45. *What is the difference between the imbedding of the arteries and the veins?*

The veins lie near the surface of the body; the arteries in which the blood is forced with greater power are deeply imbedded in the flesh for their better protection.

46. *Name the principal arteries of the upper extremities.*

The subclavian, the axillary, the brachial, the radial, and the ulnar.

47. *Name the principal arteries of the lower extremities.*

The external and internal illiac, the femoral, popliteal, anterior and posterior tibial.

48. *Name the arteries of (1) the stomach, (2) liver, (3) spleen, and (4) kidneys*

(1) The gastric, (2) hepatic, (3) splenic, (4) renal.

49 *What are the Venæ Cavæ?*

They are the two large trunk veins that connect with the right auricle of the heart; one is called vena cava ascendens, and the other vena cava descendens.

50. *Give the course of the blood in the Pulmonic Circulation.*

The dark blood collects in the right auricle, thence passes into the right ventricle, thence into the pulmonary artery, thence to the lungs, returning through the four pulmonary veins to the left auricle.

51. *Give the Systemic or Greater Circulation.*

From the left auricle to the left ventricle, thence into the great aorta, thence into the arteries, capillaries, and veins; it returns through the venæ cavæ, ascending and descending, into the right auricle.

52. *Give the entire Circulation of the Blood.*

Left ventricle, aorta, arteries, capillaries, veins, vena cava, right auricle, right ventricle, pulmonary arteries, lungs, pulmonary veins, left auricle, to the left ventricle or place of beginning.

53. *What is the Portal Circulation?*

It is the passing of the blood that returns from the alimentary canal to and through the liver before reaching the heart. The veins from the stomach and intestines lead into one large vein called the portal vein.

54. *What is the difference in the color and flow of the blood in the arteries and in the veins?*

The blood from the arteries is a bright red, that from the veins a dark purple; the blood from the arteries spurts at each pulsation, that of the veins flows in a steady stream.

55 *What becomes of the blood in the Capillaries?*

Much of it is converted into living muscle or other tissues of the body.

56. *Where is most blood sent?*

Into the brain, which receives many times as much blood as any other organ.

57. *When headache results from too much blood flowing to the brain, how may it be relieved?*

Moderate exercise will relieve it by causing the blood to flow to the muscles.

58. *What effect have the lungs upon the blood?*

They purify the venous blood; the oxygen of the air is united with the carbon, and is exhaled as carbonic acid gas.

59. *How does the position of the body affect the circulation?*

It is faster when we are walking than standing, faster when standing than when sitting, and faster when sitting than when lying down. The heart beats faster in the morning than in the evening.

60. *How does the mind affect the circulation?*

When the mind is aroused the blood flows more freely, and we are capable of greater exertions.

61. *How are the waste particles of the body disposed of?*

They are thrown out of the system by the lungs, skin, kidneys, and liver.

62. *What are the two great purposes of the circulation of the blood?*

To carry nutrition to all parts of the body, and to carry off the waste particles.

63. *What is the cause of Fainting?*

Want of blood in the brain. Placing the person who faints

in a horizontal position, with head low, will relieve the fainting, by causing more blood to flow to the brain.

64. *When blood flows freely from a wound, how can we tell whether a vein or artery is severed?*

The blood from an artery is of a bright red color, and flows in jets; that from a vein is dark red, and flows regularly.

65. *Where should pressure be applied to stop bleeding?*

In an artery between the wound and the heart; in a vein beyond the wound.

66. *What arteries are found near the surface?*

One in the wrist, where the pulse can be felt; the other on the temple.

67. *What is the effect of cold on the blood vessels?*

They are contracted by cold; hence a chill in any part of the body drives the blood to other parts.

68 *What is the effect of a chill on the surface of the body?*

It drives the blood to the internal organs; hence the necessity of warm clothing.

69. *What effect does breathing vitiated air have on the circulation?*

The heart beats more feebly, and the pulse becomes weak.

70. *What is the normal temperature of the blood?*

Ninety-eight degrees, Fahrenheit.

71. *What is the relative temperature of the blood in quadrupeds, birds, fishes, and reptiles?*

It is highest in birds, and lowest in fishes. In reptiles the blood is cooler than in quadrupeds.

72. *What is Congestion?*

An unnatural accumulation of blood in any part of the body.

73. *What is Blushing?*

A temporary congestion of the cheeks; the small arteries of the face suddenly dilate, and the vessels contain an increased quantity of blood.

74. *What is Inflammation?*

It is an irritation or injury at any spot to which an increased supply of blood is sent, resulting in heat, redness, pain, and swelling.

75. *What is Scrofula?*

It may be considered a blood disease, and is one affecting

the lymphatic glands, most commonly those of the neck; it is liable, however, to attack any organ

76. *Where do the two circulations begin and end?*

The systemic or greater circulation is considered as beginning at the left ventricle, and ending at the right auricle; the pulmonary or lesser circulation begins at the right ventricle, and ends at the left auricle

77. *How does the figure 8 illustrate the two circulations?*

The double course of the blood is sometimes likened to the figure 8, the upper loop representing the pulmonary, and the lower loop the systemic circulation, the heart being placed at the crossing of the lines.

78. *What is the size of the human Heart?*

Nearly as large as the closed hand.

79. *Where does the Heart strike against the walls of the Chest?*

Usually between the fifth and sixth ribs, and one or two inches to the left of the sternum.

80 *What part of the heart strikes against the chest walls?*

Its point or apex, which is its lowest part, as the heart hangs with the apex downward.

81. *What sounds are made at each beat of the Heart?*

Two sounds, followed by a silence; the first is dull, the second is quicker and sharper.

82. *What circulations in living beings are accomplished without hearts?*

The majority of circulations in organic forms are accomplished without hearts; plants have none; fishes have no systemic heart; in man the portal circulation has none. —*J. W. Draper.*

83. *Where are the Kidneys?*

They lie on each side of the spinal column, in a line with the lumbar vertebræ.

84. *Describe the Kidneys.*

They are excretory organs, two in number, between four and five inches long, and two and a half inches broad and one in thickness. They are of bean shape, and of a reddish color.

85. *How is blood brought to the Kidneys?*

By the renal or emulgent artery from the aorta, and is carried back into the vena cava.

86. *What is Lymph?*

A thin, colorless liquid which circulates through the lymphatics. It is much like the serum of the blood, and is thought to be an overflow from the blood-vessels.

87. *What are the Lymphatics?*

They are minute vessels like capillaries, which proceed from various parts of the body, and unite into larger trunks, which empty into the veins in the lower part of the neck

88. *What are the Lymphatic Glands?*

They are hard bodies of various sizes through which the lymphatics pass. They are often enlarged by disease so that they can be felt.

89. *What is the object of the Lymphatic Circulation?*

It is known to be connected in some way with the circulation of the blood, but its purpose is not clearly understood.

90. *What is the specific gravity of the blood?*

It is nearly exactly 1—that is, its weight is about the same as water.

91. *Has the Heart sensibility?*

It is nearly destitute of the sensation of touch, yet it is instantly affected by every painful bodily excitement.

92. *Why are students liable to cold feet?*

The intense employment of the brain draws the blood to that organ, leaving the extremities without a sufficient supply.

93. *Why does a hot foot-bath often relieve the headache?*

The hot bath congests the surface of the feet, and thus draws the excess of blood from the head

94. *What vein begins and ends in capillaries?*

The portal vein; it begins in the capillaries of the digestive organs, and ends in those of the liver.

95. *Why can the Pulse be best felt in the wrist?*

Because an important artery (the radial) there comes near the surface.

96. *Which side of the Heart is the stronger, and why?*

The left, because the left ventricle forces the blood further than the right.

97. *How does the Heart receive blood for its own nourishment?*

The corona artery passes from the aorta near its origin, and supplies the muscular walls of the heart with blood.

98. *What is the position of the Heart with reference to the Lungs?*

The heart is almost wholly surrounded by the lungs.

99. *Explain how the Heart acts both as a force pump and suction pump.*

It forces out the blood through the arteries as a force pump does water, and by suction it draws the blood back again through the veins.

100. *What fact led to Harvey's discovery of the circulation of the blood?*

The fact that there are valves in the veins permitting the blood to pass only in one way led Harvey to infer that the blood moves only in one direction through the veins, and consequently in the opposite direction in the arteries.

## RESPIRATION AND THE VOICE.

1. *Name the Respiratory and Vocal Organs.*

The Larynx, the Trachea, the Bronchi, and the Lungs, all being acted upon by a complicated series of muscles.

2. *What is the Larynx?*

It is the organ of the voice, and is a short, triangular, and cartilaginous cavity, extending from the root of the tongue to the trachea; it is separated from the spinal column by the pharynx.

3. *What is the "Adam's apple?"*

It is the front part of the larynx, and is a prominence in the neck which can be seen or felt.

4. *How are Vocal Sounds produced?*

By the vibration of cords located in the larynx.

5. *Describe the Vocal Cords.*

They are not strings, but simply folds of the mucous membrane that lines the larynx; two of these folds are above and two below.

6. *What is the Glottis?*

The opening from the throat into the larynx.

7. *What is the Epiglottis?*

It is the cover of the larynx, or a spoon-shaped lid, which opens freely for the passage of air, but closes when we swallow food.

8. *Name the Cartilages of the Larynx.*

They are seven in number; two Arytenoid, two Cuneiform, one Cricoid, one Thyroid, and the Epiglottis.

9. *In what condition are the Vocal Cords in ordinary breathing?*

They are relaxed so that the air passes through the larynx freely to and from the lungs.

10. *How are vocal sounds produced?*

The cords are drawn tightly, so as to nearly close the air passage; the air is forced between them, and they are made to vibrate rapidly, and thus produce sound.

11. *Upon what does loudness of voice depend?*

Upon the force with which the cords are made to vibrate, and this depends largely upon the power with which the breath is forced out of the lungs.

12. *Upon what does the pitch of the voice depend?*

Chiefly on the tension of the cords, but partly on the elevation of the whole larynx.

13. *What is the effect of the size of the Larynx on the voice?*

A large larynx usually gives a deep-toned voice; a smaller one a comparatively higher pitch. The cavity of the larynx is greater in the male than in the female.

14. *What is the Trachea?*

A vertical tube about an inch in diameter and four inches in length, extending from the larynx to the bronchi.

15. *What are the Bronchi?*

Two branches of the trachea which carry the air to the lungs; as soon as they enter the lungs they divide and subdivide into smaller branches called bronchiæ.

16. *Describe the Lungs.*

They are two large lobes that fill the chest, and are formed of the bronchial tubes and air-cells, and blood-vessels of the pulmonic circulation.

17. *What two great sets of passages in the Lungs?*

One for the air, and one for the blood; they are brought as closely together as possible, so as to expose the blood to the action of the air.

18. *What is the Pleura?*

A thin, delicate membrane lining the outside of the lungs, and also the inner surface of the chest.

19 *What is the Diaphragm?*

A thin, broad, circular partition across the body, separating the abdomen from the chest.

20. *What are the Intercostal Muscles?*

The muscles whose fibers fill the spaces between the ribs; they are employed in breathing.

21. *When air is inhaled what motion takes place in the ribs and diaphragm?*

The ribs are elevated, and the diaphragm lowered, and thus the chest is enlarged.

22. *Why do these motions enlarge the chest?*

The ribs pass obliquely downward to the front; when they are elevated in front, the diameter of the chest is enlarged. The diaphragm is convex on its upper side; when it descends it presses the walls of the abdomen outward.

23. *Describe the act of Expiration or Exhalation.*

The walls of the abdomen are drawn in, and the diaphragm pressed upward, while the ribs are pulled downward—thus diminishing the size of the chest, and forcing the air outward.

24. *How is ordinary breathing performed?*

"Ordinary, quiet breathing is performed mainly by the diaphragm—one breath to every four beats of the heart, or eighteen per minute."—*Steele.*

25. *What force is excited in drawing a full breath?*

It is said that in drawing a full breath the muscles exert a force equal to raising a weight of 750 pounds.

26. *What is Sighing?*

It is merely a prolonged inspiration, followed by an audible expiration.

27. *What is Coughing?*

A violent expiration, in which the air is driven through the mouth.

28. *What is the Hiccough?*

A violent inspiration, caused by the contraction of the diaphragm; the sound is produced by the air striking the closed glottis.

29. *How are the sounds in laughing and crying produced?*

They are produced in both cases by short and rapid contractions of the diaphragm.

30. *What causes Snoring?*

In snoring the air passes through both the nose and the mouth, and the peculiar sound is produced by the rapid vibration of the palate in the divided current.

31. *What purpose does Respiration serve?*

Its immediate object is the purification of the blood, and its ultimate objects are the production of heat, motion, and nervous energy.

32. *How much air can be taken in at one Inhalation?*

In a full inspiration a man of medium size will inhale about 230 cubic inches.

33. *How much air do we inhale in ordinary breathing?*

Only about twenty-five cubic inches at a time, or less than a pint.

34. *Is it possible to expel all the air from the Lungs?*

No; it is found that about 100 cubic inches always remain in the lungs after the most forcible expiration we can make.

35. *What is the capacity of the Lungs?*

The full capacity of the lungs is found by adding the amount of air we can inhale at one time to the amount remaining in the lungs after a forcible expiration; it is, on the average, about 330 cubic inches, or about eleven pints.

36. *What is the difference in the air inhaled and exhaled?*

The air when exhaled contains more carbonic acid, moisture, and organic impurities, and is almost always of a higher temperature.

37. *Describe the action of the air in the Lungs.*

The air gives up its oxygen to the blood, and receives carbonic acid gas, water, and waste matter from the system.

38. *How much oxygen does the air lose in the Lungs?*

About one-fourth part, and gains an equal weight of carbonic acid and other substances.

39. *What is the composition of pure Air?*

It is composed of oxygen and nitrogen in about the proportion of 21 to 79. There is also always some carbonic acid gas in the atmosphere, and traces of other gaseous substances.

40. *What purposes does the Oxygen of the atmosphere serve?*

It is the life-giving principle of the air for all forms of animated nature; it is also the supporter of combustion.

41. *Of what service to man is Nitrogen?*

It dilutes the oxygen, which is too active and rich to be breathed in its undiluted state.

42. *What are some of the characteristics of Carbonic Acid?*

It destroys life by suffocation, and extinguishes flame. It is, however, an essential food of plants.

43. *Describe the manner in which the Air and the Blood are brought together.*

The impure blood is carried to the pulmonary capillaries which surround the air-cells of the lungs; through the thin walls of the capillaries the carbonic acid passes from the blood into the air-cells, and the oxygen passes from the air-cells into the blood.

44 *What is the source of Animal Heat?*

The chemical changes in every part of the body caused by the union of oxygen with carbon, hydrogen, and other elements of the blood and tissues.

45 *Why do lamps burn dimly in a crowded lecture-room toward the closing hour?*

They are bedimmed by carbonic acid gas and other impurities in foul air.

46. *How much Carbonic Acid is exhaled from the Lungs in twenty-four hours?*

It varies from one to three pounds per day.

47. *How much watery vapor is exhaled?*

The quantity ranges from sixteen to twenty ounces in twenty-four hours.

48. *How does Respiration vary with the Stature?*

After 5,000 observations Dr. Hutchinson deduced the following principle: "For every inch of stature from five to six feet, eight additional cubic inches of air are given out after a full inspiration."

49. *Is Animal Heat generated only in the Lungs?*

No; it is generated in every part of the body, and is incessantly being produced.

50. *What is the Chemical Theory of Animal Heat?*

It is the theory that the heat of the body is maintained solely by chemical combinations, as in ordinary combustion.

51. *What is the Chemico-Vital Theory of Animal Heat?*

It is the theory that animal heat is generated by a chemico-vital process; that is, a process partly chemical and partly vital, and, so far as it is vital, is beyond comprehension.

52. *What malformation of the Lungs is produced by tight clothing?*

Constriction of the lungs caused by forcing the ribs inward, and thus diminishing the size of the chest and lungs.

53. *What two-fold injury is done by continued pressure of the Chest?*

It does harm to the whole body by preventing a sufficient aeration of the blood, and it does special injury to the lungs themselves.

54. *What is Bronchitis?*

An inflammation of the mucous membrane of the bronchial tubes.

55. *What is Pleurisy?*

An inflammation of the pleura, or the outer lining of the lungs, and the inner lining of the chest.

56. *What is Pneumonia?*

An inflammation of the lungs, chiefly affecting the air-cells.

57. *What is Croup?*

An inflammation of the mucous membrane of the larynx and trachea; it often attacks young children.

58 *What is Diphtheria?*

A form of sore throat in which offensive matter exudes from the mucous membrane of the throat.

59. *What is Asphyxia?*

It is a state induced by an interruption of respiration, as in drowning or strangling; it is suspended animation from the non-aeration of the blood

60. *What is Consumption?*

It is the most common and fatal of pulmonary diseases, and consists of the actual disorganization of the substance of which the lungs are composed.

61. *What diseases are believed to be brought on or aggravated by breathing foul air?*

Consumption, catarrh, scrofula, and some forms of fever.

62. *What similarity is there in the functions of the Lungs, the Skin, and the Kidneys?*

They are called the scavengers of the body; they all carry off water and impurities from the system, and when any one fails to perform its office, the others are called on to do increased work

63. *What is said of the relative frequency of Respiration in different persons?*

It is more frequent in women and children than in men, and in persons of small stature than in taller people.—*Cutter.*

64. *What conditions increase the number of respirations?*

The number of respirations is increased by exercise, food, stimulants, and moderate cold; it is diminished by mental depression.

65. *How is the blood of a fish aerated?*

The gills of a fish are its lungs; water always contains some air, and as the water passes into the gills the air contained in it acts upon the blood-vessels of the fish.

66. *What kind of Lungs do insects have?*

Merely air-cells in different parts of the body, with holes opening into them on the sides of the insect. The grasshopper has twenty-four of these holes, in four rows.

67 *How does the breathing apparatus of birds assist them in flying?*

Birds have sacs, or bags, in different parts of the body, which they inflate with air when they fly.

68. *How does Drowning produce death?*

By preventing the oxygen from reaching the blood; the water does not directly cause death, but indirectly by stopping the arterialization of the blood.

69. *What should be done in a case of suspended animation from Drowning?*

The lungs and air vessels should be emptied of water; the arms of the patient should be drawn forward and backward in order to draw air into the lungs; pressure upon the chest should alternate with blowing air into the mouth.

70. *How long has suspended animation continued without resulting in death?*

In cases of asphyxia life has been restored after five hours of suspended animation.

71. *What different kinds of suspended animation require similar treatment?*

Asphyxia, or apparent death, whether produced by drowning, suffocation, bad air, or coal gas, requires very similar treatment.—*Steele.*

72. *Why does burning charcoal in an open pan cause death?*

The combustion of the coal produces carbonic acid gas, which produces asphyxia, or suffocation. Illuminating gas produces the same effect.

73. *What two kinds of Respiration are there?*

Abdominal, which is performed chiefly by the diaphragm, and pectoral, which is performed chiefly by the ribs.

74. *How is the hiss of the serpent produced?*

Serpents are capable of inhaling a large quantity of air, and their peculiar hiss is simply a prolonged expiration of air.

75. *Do Reptiles have larynges?*

They have an imperfect kind of larynx, but the only sounds they can produce are the croak of the frog and the hiss of the turtle, serpent, and lizard.

76. *What peculiarity is there in the larynges of Birds?*

Birds have a larynx at each end of the trachea; their vocal sounds are made by the lower one.

77. *Do Insects produce vocal sounds?*

No; insects have no larynx or vocal organs; the sounds they make are not vocal.

78. *How do the Grasshopper and Locust produce sounds?*

By rubbing together the anterior pair of wings upon the nervures or framework of the wings, on which are found file-like edges.

79. *How is the sound called "the death watch" produced?*

A species of beetle which bores in old timber produces this sound by striking its mandible against the hard woods. Some ants make similar sounds.

80. *Is a whisper a vocal sound?*

No; whispering is produced by modifications of the breath in the mouth without vocalization; that is, without the action of the larynx.

81. *What is the Sinus?*

It is the cavity in the frontal bone which communicates with the pharynx.

82 *What is the effect of the Sinus on the voice?*

It imparts a resonance to the voice in the same manner that the hollow portion of the violin gives a proper tone to that instrument.

83. *How does a Cold affect the voice?*

The cold closes up the passage to the frontal sinus, and by a thickening of the lining membrane prevents a resonance of the tones.

84 *What is a Vowel, and what is a Consonant?*

A vowel is a pure vocal sound produced by the action of the larynx; a consonant is a mouth sound produced by the breath, and modified by the lips, tongue, teeth, and palate.

85. *What different kinds of Consonants are there?*

Those made by the lips are called labials; by the tongue, linguals; by the tongue pressing against the teeth, dentals; by the palate, palatals.

## THE NERVOUS SYSTEM.

1. *What is the Nervous System?*

   It is that part of the animal organism by which the different parts of the body are controlled and caused to work together, and through which mind and body are connected.

2. *Name the organs of the Nervous System.*

   The brain, the spinal cord, the nerves, and the ganglia of the nerves.

3. *What two kinds of matter in the Nervous System?*

   The white and the gray.

4. *Describe Nervous White Matter.*

   It consists of milk-white, glistening fibers, sometimes less than one twenty-five thousandth part of an inch in diameter; these fibers are the conductors of nervous power.

5. *Describe Nervous Gray Matter.*

   It is made up of small ashen-colored cells, forming a pulp-like substance, which is the generator of nervous power.

6. *What is meant by Nervous Force?*

   We do not know what it really is; it is like electricity in some respects, and in others it is very different.

7. *What are the Ganglia?*

   They are masses of gray nervous matter, sometimes called nerve centers; they correspond to the telegraph stations, and the nerve fibers to the wires.

8. *What is the Brain?*

   It is the great center of the nervous system, and the seat of the mind.

9. *What is the shape and size of the Brain?*

   It is egg-shaped, with the smaller portion in front; it weighs something more than three pounds on the average, or about one-fortieth of the body.

10. *Give the weight of some remarkable Brains*

Cuvier's, 64½ ounces; Webster's, 53½; James Fisk's, 58; an idiot's is about 20. The average in man is 50; in woman, 45 ounces.

11. *How is the Brain protected?*

It is securely lodged in a strong bony case, and is covered with three membranes, and is surrounded by fluids.

12. *Name the three membranes covering the Brain*

The outer one is the Dura Mater, which also covers the spinal cord; the middle one is the Arachnoid membrane, and the one on the surface of the brain is the Pia Mater.

13. *What is the Cerebrum?*

It is the front and upper part of the brain; it is sometimes called the Great Brain, and in man comprises about seven-eighths of the entire weight of the brain.

14. *What is the Cerebellum?*

It is the back and lower part of the brain, and is sometimes called the Lesser Brain.

15. *In what sense do we have two Brains?*

The cerebrum, which is the center of thought, is divided into two parts by a deep fissure or cleft running from the front to the rear; these are called right and left hemispheres.

16. *How is each hemisphere of the Cerebrum divided?*

Into three lobes, called the frontal, middle, and posterior lobes, the frontal being the largest. There is also a small offshoot from the frontal lobe called the Olfactory.

17. *What are the Convolutions of the Brain?*

Each lobe of the cerebrum has on its surface many tortuous and complicated elevations, called convolutions; these give the surface a curiously wrinkled and folded appearance.

18. *What are the Sulci?*

They are the winding fissures or depressions between the convolutions.

19. *How do the Convolutions indicate mental power?*

It is found that the higher the mental development the more complicated and unsymmetrical are the convolutions, and the deeper the depressions between them. This is seen in comparing the brains of the lower animals and of different races of men.

20. *Do the Convolutions correspond with the "bumps" or elevations of the skull?*

They do not; the convolutions are much more numerous and intricate than the elevations on the skull.

21. *What kind of nerve matter is found in the Brain?*

Both the gray and the white; the gray matter covers the entire surface to the depth of one-fourth of an inch; the white matter is within.

22. *What are the supposed uses of the different parts of the Brain?*

The cerebrum is thought to be the organ of thought and intelligence; the cerebellum, the controller of muscular movements

23. *What is the effect of removing the cerebrum in living animals?*

The animal may continue to live, and can stand, walk, and breathe, but it seems to lose all power of judgment and mental activity.

24. *What is the effect of removing the Cerebellum?*

If the cerebellum only be removed the animal appears to maintain its mental faculties, but loses all control over its voluntary muscles.

25. *What is the Spinal Cord?*

It is the nervous matter in the cavity of the back-bone.

26. *Describe the structure of the Spinal Cord.*

It is composed of white nervous matter on the outside, and gray matter within; it is nearly cylindrical, and is divided by a fissure into two parts, one for each side of the body.

27. *What is the Medulla Oblongata?*

It is the enlargement of the spinal cord as it enters the skull

28. *Describe the Nerves*

They are glistening, silvery threads, composed, like the spinal cord, of white matter without and gray matter within; they are the conductors of nervous influence.

29. *What two kinds of Nerves are there?*

Motory and sensory; those which carry the dictations of the mind to the different organs are called motory; those which carry impressions from the different parts of the body to the brain are called sensory.

30 *If the hand be burned, how do the two kinds of nerves operate?*

The sensory nerves carry the impression of pain to the brain, the motor nerves carry the order of the mind to the muscles, and they contract, and withdraw the hand.

31. *Does the same fiber ever act both as a nerve of sensation and of motion?*

No; the two kinds of fibers are always separate in their office, although both kinds of fibers may be bound up together in the same nerve.

32. *Where are the sensory and motor nerves bound up together?*

In the body and limbs.

33. *Where are the two kinds separated?*

In the face the sensory and motor fibers are in two separate sets of nerves; everywhere else they are bound up together.—*Hooker.*

34. *What three classes of Nerves are there?*

The spinal, the cranial, and the sympathetic.

35. *What are the Spinal Nerves?*

They are thirty-one pairs of nerves which issue from the spinal cord through apertures in the back-bone

36. *What are the Cranial Nerves?*

They are twelve pairs of nerves springing from the lower part of the brain and the medulla oblongata.

37. *What are the Sympathetic Nerves?*

They are the nerves of organic life; they run from the ganglia, on each side of the back-bone, to the heart, lungs, stomach, etc., and also to the spinal and cranial nerves.

38 *What is the Sympathetic System?*

It consists of a double chain of ganglia on each side of the spinal column and the sympathetic nerves leading from it. It binds the whole system together with cords of sympathy.

39. *Describe the roots of the Spinal Nerves.*

Each spinal nerve has two roots, by which it is attached to the spinal cord; the one attached to the front part of the cord is the motor root, and the one attached to the back part is the sensory root.

40 *What is the effect of the destruction of either of the roots?*

When the anterior root is cut or destroyed, the animal loses the power of motion; when the posterior is destroyed, that of feeling.

41. *What organ of the body has the most nerves?*

The eye; each eye has two different nerves of sensation, and four of motion.—*Hooker.*

42 *Why does the sawing of the bone of a limb cause little or no pain?*

Because there are few nerves in the bones.

43. *In amputating a limb, what occasions most suffering?*

The cutting through the skin, which has a full supply of the nerves of sensation.

44 *Are there many nerves in the Muscles?*

They are well supplied with nerves of motion, but few of sensation; there is, therefore, not much feeling in the muscles.

45. *Describe "the crossing of the cords."*

The nerves of motion from the right side of the body pass to the left side of the brain, and *vice versa*. The nerves from the two hemispheres of the brain cross each other in the medulla oblongata.

46 *Why in paralysis are the limbs sometimes motionless on one side and the face on the other?*

Because the nerves of the face do not cross, while those of the muscles of the limbs do.

47 *Why may an injury to the spinal cord cause a loss of motion in one leg and a loss of feeling in the other?*

Because the sensory fibers of the spinal nerves cross over to the opposite side of the spinal cord, while those of motion do not cross until they reach the base of the skull.

48. *In what sense is the white part of the brain like the nerves?*

It is composed, like the nerves, of very fine fibers. "It is, indeed, a great central collection of the beginnings of nerves that branch out all over the body."

49. *What is the Reflex Action of the Nervous System?*

It is the action of nerve centers without the conscious action of the mind.

50. *Give examples of Nervous Reflex Action.*

Winking involuntarily at a blow aimed in sport at the eye; starting at a sudden sound; the instantaneous catching of our balance when we are about to fall.

51. *What is "Unconscious Cerebration?"*

It is a term employed by Dr. Carpenter to express the reflex action of the brain, or the unconscious working of the mind on one subject when we are directing our attention to another matter.

52. *Give an illustration of Unconscious Cerebration.*

In conversation, when we forget a name, and, after painful and fruitless efforts to recall it, we dismiss the matter from our minds, and converse on another subject, the name suddenly and unexpectedly recurs to us.

53. *What is the supposed explanation of the sudden solution of a difficult question after it has been dismissed from the mind?*

The action of the brain in such cases is supposed to be reflex, or automatic; having received an impulse in a certain direction, when left to itself, it works out the desired result.

54. *Why can we play a familiar tune and carry on a conversation at the same time?*

An act which at first demands all our attention requires less by constant practice, until it becomes mechanical; the mind is supposed to act reflexively in directing the muscles in playing a familiar tune.

55. *Give Dr. Draper's theory with reference to the mind acting on two matters at the same time.*

Dr. J. W. Draper says that the two hemispheres of the brain may act separately or conjointly; and the insane man may indulge in two synchronomous trains of thought; he never indulges in three, for the reason that he has not three hemispheres, and the same remark applies to the sane man in the accidental wanderings of his mind.

56. *What useful purpose is served by the division of the Brain into hemispheres?*

It is a well-known fact that one of the hemispheres may be diseased or injured so as to perform its function imperfectly, yet the other be in its healthy state; and it seems

probable that the mind may remain active with only one hemisphere performing its functions.

57. *Is the whole Brain absolutely essential to life and mental operations?*

No; for there are instances of a considerable portion of the brain being removed by accidents, and the mind remaining sound during many years of life afterward.

58. *Is the Brain a sensitive organ?*

No; it may be cut, burned, or electrified without producing pain.

59 *What parts of the Nervous System are sensitive?*

All parts except the brain; every nerve and every part of the spinal column are keenly alive to the slightest touch.

60. *Of what substances does the Brain consist?*

"Eight per cent. of water, seven of albumen, some fat, and a few minor substances constitute the instrument which rules the world."—*Steele.*

61. *What reasons are there for the belief that the Cerebrum is the instrument of the Intellect?*

A severe injury inflicted upon it results in a total loss of intellectual power; any lesion by disease is attended with a lowering of mental power; and great intellects have large cerebrums.

62. *What is Sleep?*

A state of the body in which there is more or less perfect suspension of the activity of the brain.

63. *What vital functions proceed during Sleep?*

Digestion, secretion, and respiration are carried on during the soundest sleep, but with less activity than when we are awake.

64. *Why do infants and aged persons need most sleep?*

Infants need much sleep in order that the constructive process may go on uninterruptedly; old persons, because the vital energies are feeble.

65. *What rules for sleeping hours can be given?*

Sleep should be taken regularly as often as once a day; the more rapid the nervous exhaustion the more sleep is required; in general, one should sleep until he naturally wakes; brain-workers need more sleep than those engaged in manual labor; most persons need not less than eight hours of sleep.

66. *What is the Arbor Vitæ of the Brain?*

It is a name given the ridges in the cerebellum which let the gray matter in the white matter, and give it a tree-like appearance.

67 *How large is the Cerebellum?*

Somewhat smaller than the closed hand.

68. *What proportion of the blood of the body does the Brain receive?*

About one-sixth of all the blood is sent to the brain, although its weight is only about one-fortieth of the body.

69. *What are the Ventricles of the Brain?*

There are several cavities in the brain, called ventricles; their use is not fully understood

70. *What is the effect of Impure Blood on the Nervous System?*

The nervous system is dependent on the blood for the repair of its waste matter; hence, faulty nutrition and impure blood result in nervous weakness.

71. *Name some hygienic necessities of a clear and healthy Brain.*

A healthy brain needs nutritious food, pure air, a good digestion, and a proper alternation of exercise and rest.

72. *In what sense is Insanity hereditary?*

Insanity is the result of weakness or disease of the nervous system; the children of the insane inherit from their parents nervous weakness rather than mental unsoundness.

73 *Name some of the most common causes of Insanity.*

Lack of proper nourishment, prolonged exhaustion by disease, excessive grief, great excitement, overwork, and financial embarrassment.

74. *In what three ways may the tired Brain be recuperated?*

By sleep, by a change from one kind of mental work to another, and by recreation and amusement. Of these, sleep is absolutely necessary; the others give partial rest.

75. *What part of the Nervous System would be pierced by a ball passing from the opening of one ear to the other?*

The medulla oblongata.

76. *What is said of the sensitiveness of this organ?*

The medulla oblongata is the most exquisitely sensitive portion of the whole nervous system.

77. *What is the most fatal spot of the Nervous System?*

The origin of the pneumogastric nerve in the medulla oblongata; the least injury at this point causes instant death.

78. *What is the Pneumogastric Nerve?*

It is the nerve which passes from the medulla oblongata to the stomach, liver, and lungs, and controls the process of breathing.

79. *What is a Plexus?*

It is a network or group of nervous fibers; most of the nerves are grouped together into plexuses after leaving the spinal column.

80. *How do the large nerves generally run?*

The largest and most important nerves follow the same general direction as the larger blood vessels, and are generally in close proximity to them.

81. *What are the Pacinian Corpuscles?*

They are the minute oval terminations of the nerve fibers in the skin of the hands and feet, so called from their discoverer, Pacini.

82. *What is the cause of the foot being "asleep?"*

Compression prevents the nervous force from passing, and the tingling sensation is felt where the nerve starts.

83. *Why do persons with amputated legs often feel sensations in the toes?*

The irritation of the nerves at the stump of the amputated limb is referred to the points to which the nerves formerly led.

84. *How rapidly does the nervous force travel?*

Over one hundred feet per second.

85. *Explain the peculiar feeling resulting from striking the "funny bone" behind the elbow.*

The nerve here irritated is the ulnar nerve, and gives sensation to the third and fourth fingers, and the pain is referred to these fingers by the mind.

86 *What nerves carry the sensation of toothache and neuralgia?*

The trifacial pair of cranial nerves; they divide into three branches, and pass to the face and the upper and lower jaw.

87. *What nerve extends farthest from the Head?*

The pneumogastric; branches of this pair of nerves extend to the heart, lungs, liver, stomach, and intestines.

88. *What nerves give expression to the Face?*

The portio dura, or facial nerves.

89. *What is the Tentorium?*

It is a tough membrane separating the cerebrum from the cerebellum.

90 *What inorganic substance is found in the brain in larger proportions than in any other organ of the body?*

Phosphorus; it is found in the brain, spinal cord, and nerves, chiefly in the form of phosphates.

91. *What food contains a large proportion of phosphorus?*

Fish contain more phosphorus than any other kind of food.

92 *What is the peculiarity of the nervous system of Fishes?*

Fishes have the lowest development of the nervous system of vertebrates.

## THE SPECIAL SENSES.

1. ***What is meant by the Special Senses?***

They are the outlets of the soul, or the means by which the mind is made acquainted with external objects.

2. *What are the organs of the Special Senses?*

The tongue, the nose, the ear, the eye, and the tactile portions of the nervous system.

3. *How many and what are the Special Senses?*

They are usually reckoned as five in number, viz.: Seeing, Hearing, Tasting, Smelling, and Feeling.

4. *What is the comparative development of the Senses in Man and the Lower Animals?*

They are much more acute and more fully developed in many of the lower animals than in man.

5. *What is the peculiarity of the nerves of the Senses?*

They are incapable of performing any function except the one for which they were designed; for instance, the opti nerve can not perform the function of feeling.

6. *Does the Olfactory Nerve carry the sensation of pain from a wound in the nostrils?*

No; one set of nerves carry the sensation of smell, and another that of feeling in the nostrils.

7. *Describe the Eye.*

The human eye is nearly globular in form, and about an inch in diameter; it is lodged in a bony cavity, protected by the overhanging brow.

8. *Of what is the Eye composed?*

It is made up of three membranes and three humors or transparent media, and is covered on the surface exposed to the air by mucous membrane.

9. *What is the Sclerotica?*

It is the membrane which covers the ball of the eye; it is commonly called the white of the eye.

10. *What is the Cornea?*

It is the convex, transparent part in front forming the window of the eye.

11 *Is the Cornea a part of the Sclerotica?*

Some anatomists consider that the cornea is continuous with the sclerotic coat; others regard the cornea as a separate organ, and set into the sclerotic coat like a watch-glass.

12. *What is the Choroid Coat?*

A black or dark lining of the posterior part of the eye to absorb the superfluous light; so called because of its resemblance to a chorion

13 *What is the Iris?*

It is the colored curtain surrounding the pupil; the color of the iris gives name to the color of the eye.

14. *What is the Pupil?*

It is the circular opening in the iris through which light passes into the eye.

15. *What is the Retina?*

A soft, pulpy, grayish, semi-transparent, and inner membrane of the eye, and is formed by the expansion of the

optic nerve. It embraces the vitreous humor, and lines the choroid, without adhering to either of them

16. *With what is the hollow of the Eye filled?*

Three fluid or semi-fluid substances—the Aqueous Humor, the Crystalline Lens, and the Vitreous Humor.

17. *What is the Aqueous Humor?*

It is a fluid, like water, in the front part of the eye; it is just behind the cornea.

18. *Describe the Lens.*

The crystalline lens is a humor situated immediately behind the pupil; it is a double convex lens.

19. *Describe the Vitreous Humor.*

It is a fluid forming the greater part of the interior of the eye; it is enclosed in a transparent membrane.

20. *What is the Hyaloid?*

It is a membrane enclosing the vitreous humor; it also extends into the interior of the eye, and forms cells in which the vitreous humor is held.

21. *Name the Protecting Organs of the Eye.*

The orbits, the eyebrows, the eyelids, and lachrymal apparatus.

22. *Describe the Orbits.*

They are deep, bony sockets in which the globes of the eye are placed.

23. *Describe the Eyebrows.*

They are projecting arches of fat and skin, covered with short, thick hair.

24. *Describe the Eyelids.*

They are movable coverings for the eye, consisting of membranous and muscular tissue.

25. *What are the Tarsal Cartilages?*

They are the edges of the eyelids.

26. *What are the Meibomian Glands?*

They are minute glands in the cartilage of the eyelids.

27. *What is the Conjunctiva?*

A smooth mucous membrane lining the eyelids.

28. *What difference is there in the movement of the Eyelids?*

The upper eyelid has a much greater latitude of movement than the lower.

29 *What purposes do the Eyelids serve?*

They shield the eye from mechanical violence and too powerful light, and keep the eye moist and free from dust by winking.

30. *Of what does the Lachrymal Apparatus consist?*

The lachrymal gland and its duct, the lachrymal canals, and the nasal ducts.

31. *Describe the Lachrymal Gland.*

It is situated at the outer angle of each eye, and is about three-fourths of an inch in length

32 *What are the Lachrymal Ducts?*

They are ten or twelve small ducts which pass from the lachrymal gland and open upon the inner side of the eyelids, and carry tears to the eyes.

33 *What are the Lachrymal Canals?*

They are two canals provided for each eye which carry the excess of tears into the nasal duct

34. *What is the Nasal Duct?*

It is a short canal about three-fourths of an inch in length, leading from the internal angle of the eye backward and downward.

35 *Why is the image on the Retina inverted?*

Because the crystalline lens causes the rays of light to cross each other.

36 *What is the cause of Long- and Short-sightedness?*

When the crystalline lens is too much flattened, long-sightedness results; when the lens has too much convexity, short-sightedness results.

37 *What is the effect of advancing age on the shape of the lens of the Eye?*

The lens generally is flattened with those advanced in life, and artificial convex lenses are needed to correct the defect.

38. *What is the primary purpose of the Retina and Optic Nerve?*

To receive and transmit to the brain the color and form of external objects.

39 *Why is the Sclerotic Coat hard and firm?*

To give firm attachment to the muscles which move the eye, and to protect the delicate parts within.

40. *How does the Eye receive blood?*

By means of the choroid coat, which is made up almost entirely of blood-vessels.

41. *How is the Pupil contracted?*

There are circular muscular fibers around the pupil which contract under the stimulus of strong light, and lessen the pupil.

42. *How is the Pupil dilated?*

There are radiated muscular fibers running from the pupil through the iris, which contract when the light is feeble, and enlarge the pupil.

43. *What humor of the Eye will nature replace when it is removed?*

The aqueous humor; this is not true of either of the other humors.

44. *Why are there three humors of the Eye?*

To prevent the separation of the rays of light into different colors; without the different media we would see the prismatic colors.

45. *What is meant by an Achromatic Lens?*

It is a lens made of two kinds of glass or other transparent substances. In a telescope it remedies the defect of prismatic colors seen on the edges of heavenly bodies when a lens made of only one kind of glass is used. The different humors of the eye serve the same purpose as different kinds of glass in the telescope.

46. *How is the Eye adjusted to see different distances?*

The healthy eye has the power of changing the convexity of the crystalline lens so as to adapt itself to near and distant objects.

47. *What is the usual cause of Squinting?*

Long-sightedness; the muscles are strained in order to obtain distinct vision of near objects

48. *How does the surgeon cure Squinting?*

By cutting the muscle that draws the eye out of place.

49. *What is the effect of reading type so small as to strain the Eyes?*

It is believed to cause near-sightedness, which is alarmingly on the increase in our schools. Reading by insufficient light has the same effect

50. *When should glasses begin to be worn?*

Whenever it is found that they will materially improve the sight; any delay will injure the eyes. Spectacles are often more necessary at the age of six than sixty.

51. *What is Color-Blindness?*

It is inability to distinguish between certain colors, and results from the retina being insensible to one of three elementary color sensations.

52 *What is said of the eyes of the common house fly?*

The fly has 4,000 eyes on each side of the head; that is, its eyes are made up of an aggregation of single lenses, each of which is a complete visual instrument, receiving rays coming only in one direction.

53. *What is remarkable about the eye of a fish?*

The great size and spherical form of the lens, which is necessary to give sufficient refraction to the rays coming through so dense a medium as water.

54. *How is the Ear divided?*

(1) The external ear; (2) the middle ear; (3) the internal ear.

55. *What is the Pinna?*

It is the external ear, and consists of a sheet of cartilage curiously folded.

56. *What Muscles has the Ear?*

The external ear has five muscles, which in most quadrupeds enable them to readily move the ears; these muscles exist in man in a rudimentary state; a few, however, have the power of moving the ears.

57. *Describe the Auditory Canal.*

It is an irregular tube, about one-half an inch in diameter, leading from the external to the middle ear.

58. *What is the Tympanum?*

It is the middle ear, and consists of a cavity about half an inch in its longest diameter.

59. *Describe "the Little Bones of Hearing."*

They are three little bones hanging across the cavity of the middle ear, named, from their shape, the malleus (a hammer), the incus (an anvil), and the stapes (a stirrup). All together they only weigh a few grains.

60. *What is the Labyrinth?*

It is the internal ear, and is called the labyrinth because of its very complicated character. It consists of a series of cavities and canals, some of which are bony, and others cartilaginous.

61. *What is the Eustachian Tube?*

It is a tubular passage about two inches long, and connects the tympanum with the pharynx.

62. *How many openings are there in the walls of the Tympanum?*

Ten, the most important of which are the Eustachian tube, the opening into the labyrinth, and the opening to the external ear.

63. *With what is the Internal Ear filled?*

With a watery fluid.

64. *What are the Otoliths?*

Two ear stones in a little sac floating in the fluid contained in the internal ear; the sac also contains hair-like bristles and fine sand

65. *What portions of the Ear contain air and what fluid?*

The external and middle ear are full of air, but the internal ear is filled with a fluid.

66. *Is there any internal connection between our two Ears?*

No; and for this reason one may be injured or diseased, while the other remains sound.

67. *What is the purpose of the Pinna?*

To collect sounds from as large a sphere as possible, and convey them to the auditory canal; for this reason it is funnel-shaped.

68. *What is the purpose of the Auditory Canal?*

To give greater intensity to the sounds collected by the external ear.

69 *What is the Membrana Tympani?*

It is a very thin and elastic membrane, less than half an inch in diameter, stretched across the auditory canal, and so arranged that its tension may be regulated by muscles.

70. *What is the purpose of this Membrane?*

It is the drum of the ear; it is designed to receive all the vibrations of the sound-waves falling upon it, and to transmit them to the auditory nerve.

71. *What is the purpose of the Eustachian Tube?*

It communicates with the pharynx so as to allow an equal pressure of air on both sides of the ear drum.

72. *Why does a cold sometimes cause a difficulty in hearing?*

A cold, and especially a sore throat, by inflaming the mucous membrane lining the Eustachian tube, may prevent the air from freely reaching the inner side of the ear drum

73. *What would be the effect of a larger External Ear in man?*

He could hear better, as is shown by assisting the ear in collecting sound by putting the hand up behind it, and by the use of an ear trumpet.

74 *How is sound carried from one place to another?*

By vibrations either in the air or some other matter.

75. *How many kinds of vibrations in the Ear before the sensation of sound is perceived?*

Five; (1) vibrations of the air in the tube of the ear; (2) of the drum; (3) of the chain of little bones; (4) of the cochlea; (5) of the fluid in the ear passages.

76. *What is the hardest bone in the Body?*

The temporal bone, which protects the internal ear; it is so hard that it is called the petrous, or rock-like bone.

77. *What is the object of the wax of the Ear?*

It is a bitter wax, and is designed to protect the ear from insects.

78. *Why should not the Ear be struck with the hand or a book?*

The tympanum may be thus seriously injured, and the hearing impaired.

79. *Is it possible for the sensation of sound to reach the Ear without being communicated by air-waves?*

Yes; for example, the watch may be heard to tick when placed between the teeth.

80 *How is the ticking of a watch communicated through the teeth to the Auditory Nerve?*

The vibrations are communicated to the teeth; thence to the bones between the teeth and the winding passages of the ear and to the fluids in the ear passages.

81. *What are the Ossicles of the Ear?*

The little bones of the ear.

82. *What is meant by straining the Ear to hear low sounds?*

By the aid of muscle we cause the chain of little bones or ossicles to press more firmly against the membranes.

83. *What three physical properties of sound are distinguished by the Ear?*

(1) The intensity or loudness; (2) pitch; (3) quality.

84. *Upon what does the Pitch depend?*

Upon the length of the waves of sound.

85. *What is meant by the Quality of Sound?*

It is that property by which we are enabled to determine the character of the substance from which it proceeds; for example, whether the sound is metallic or otherwise, from a stringed or reed instrument, etc.

86. *What theory has been advanced concerning the discrimination of the three properties of sound?*

That the membrana tympani enables us to determine the intensity, the cochlea the pitch, and the canals the quality of sound.

87 *Describe the structure of the Nose.*

It is principally made up of bone, cartilage, and integuments, with a thin plate of bone and cartilage in the middle running in a vertical direction.

88 *What are the Nasal Bones?*

They are two bones at the base of the nose, and they give it firmness and maintain its form

89. *Describe the Nostrils.*

They are the two openings in the nose; they run back into the pharynx, and are lined with a continuation of the mucous membrane of the throat.

90. *Why are black specks more likely to appear on the nose than other parts of the body?*

The skin covering the nose is quite thick, and contains small glands, which secrete an oily fluid. Unless the glands are kept open, and the skin clean, dust and other impurities remain in their orifices.

91 *Describe the Olfactory Nerves.*

They are the first of the twelve pairs of cranial nerves; they enter the olfactory chambers through little openings in the bony plate at the roof of the nose.

92. *Where is the sense of Smell located?*

In the delicate mucous membrane lining the nasal passages.

93. *Why do we draw air forcibly into the nostrils when we desire to detect a faint odor?*

Because the olfactory nerves are distributed only over the mucous membrane of the upper part of the nose, and the sense of smelling is restricted to this part of the nasal cavities.

94. *What useful purpose does the sense of Smell serve?*

It enables us to discriminate in the quality of food, and to avoid the injurious effects of many foul vapors.

95. *Why is Smell said to be a sense of inferior importance?*

As one of the windows to the soul, it furnishes the mind with but few ideas, and these are only subservient to our physical well-being.

96. *Where is this sense most highly developed?*

It is generally better developed in the lower animals than in man, and in carnivorous animals than in herbivorous.

97 *Why can we smell but one odor at a time?*

Because the olfactory nerves are slow in their operation, and the impression made upon them remains for some time

98. *Does any nerve besides the Olfactory enter the lining membrane of the nostrils?*

Yes; a branch of the fifth pair of cranial nerves also sends branches to this membrane. The odor of a substance, such as snuff, is perceived by the olfactory nerve; its pungency or tickling sensation by the branch of the fifth pair of nerves.

99 *Where is the sense of Taste located?*

It is confined in all animals to the tongue and inner surface of the mouth; the tongue in man is pre-eminently the organ of taste.

100. *What difference is there in the tasting power of the different parts of the Tongue?*

The back of the tongue is most sensitive to salt and bitter substances; the edges of the tongue to sweet and sour substances.—*Steele.*

101 *What are the chief uses of the sense of Taste?*

To direct us in the choice of food, and to excite the flow of saliva and mucus to aid in digestion.

102. *Describe the coat of the Tongue.*

The tongue is covered with a thick mucous membrane, which contains a large number of papillæ similar to those of the skin.

103. *Describe the action of the Papillæ in tasting.*

They start up in tasting, as can be seen by placing a drop of vinegar on the tongue before a mirror.

104. *Why is a substance with an unpleasant taste more likely to produce vomiting when placed on the back part of the tongue than on the forward part?*

Because the back part of the tongue only is supplied with nerves which are in sympathy with the stomach; these nerves are branches of the "fifth pair."

105. *What three kinds of Papillæ on the Tongue?*

The Circumvallate, the Fungiform, and the Conical.

106. *Describe the Circumvallate Papillæ.*

They are shaped like the letter V, with the point downward, and are surrounded by an annular wall, from which they derive their name.

107. *How many and where are they?*

They are about a dozen in number, and are found on the back part of the tongue.

108. *Describe the Fungiform Papillæ.*

They are something like a mushroom in shape; they are more numerous than the circumvallate, and are most numerous at and near the tip.

109. *Describe the Conical Papillæ.*

They are of conical shape, and more numerous than the others, and are arranged in rows diverging from the median line of the tongue.

110. *What gives the velvety appearance of the Tongue?*

Hair-like projections upon some of the papillæ.

111. *Why is a wholly insoluble substance tasteless?*

Because the substance tasted must be absorbed by the papillæ, and this can only be done in a liquid condition.

112. *What nerves are in the Tongue?*

Three; the Gustatory, the Hypoglossal, and the Glossopharyngeal.

113 *Why is Touch sometimes called "the common sense?"*

Because its nerves are spread over the whole body.

114. *What are the organs of Touch?*

The papillæ of the skin.

115. *What kind of nerve fibers are found in the papillæ of the Skin?*

Nerves of sensation, which always terminate in loops, and never with free extremities.

116. *What are the characteristics of the skin which is peculiarly susceptible to Touch?*

It has a deep layer of fibrous tissue; it has a delicate network of nerves running through the deeper layers, and it has an outer, insensible layer to shield the sensitive parts from injury.

117. *What fact illustrating the power of habit in the location of sensations has been shown by the Taliacotian Operation?*

"After the Taliacotian operation—which consists in making a new nose from the skin of the forehead—if the nose itches, the patient scratches the forehead as the seat of the sensation."—*Hitchcock.*

118. *Is the Eye or the Ear most liable to disease?*

"The ear is more liable to disease than the eye."—*Eclectic Physiology.*

119. *How may a disease of the throat affect the Ear?*

The inflammation of the mucous membrane of the throat may extend to the ear through the Eustachian tube.

120. *What are some of the most common causes of "ringing in the ears?"*

Congestion of the brain, nervous debility, and quinization (the effect of large doses of quinine).

121. *In what form of deafness is a patient unable to hear the ticking of a watch placed between the teeth?*

Only when it results from paralysis of the auditory nerve.

122 *How can the surgeon see the interior of a patient's Eye?*

By means of an instrument called the ophthalmascope; light is thrown into the eye, and its interior is examined with a lens.

123. *What is Cataract?*

It is a disease of the eye in which there is an opacity of the crystalline lens or of its capsule, which obscures vision.

124 *What is said of the sensitiveness of the Optic Nerve?*

It is a remarkable fact that the nerve which carries the impressions made by the rays of light on the retina is not itself sensitive to light.

125 *What is "the blind spot" of the eye?*

It is the spot on the retina where the optic nerve enters the eye; this spot is insensible to light.

126 *Give instances of injury to the eyes from an excess of light.*

Looking at the sun is painful and injurious; the reflection of bright sunlight from snow may cause permanent injury; even the direct light from a lamp or window should be avoided in reading or sewing.

127. *What is the best treatment for inflamed Eyes?*

Give them perfect rest; wear colored glasses for a time, or remain in a shaded room.

## THE PHYSIOLOGICAL EFFECTS OF ALCOHOL AND NARCOTICS.

1. *What is Alcohol?*

In its ordinary acceptation it is the spirituous principle resulting from the fermentation of saccharine bodies.

2. *From what substances can Alcohol be obtained?*

Sugar is the only substance susceptible of vinous fermentation, and the only substance from which alcohol can be derived.

3. *How is it that Alcohol can be derived from potatoes and grains deficient in sugar?*

These vegetable productions contain much starch, and the

starch is converted into sugar before alcoholic fermentation begins.

4. *Describe pure Alcohol.*

It is a highly volatile liquid, possessing a pungent odor, and a hot, burning taste; it is transparent and colorless, and about one-fifth lighter than water.

5 *Is Alcohol combustible?*

It is very combustible, and burns with a pale blue flame, without smoke, but with intense heat.

6. *If pure Alcohol be left in an uncorked bottle, what will be the result?*

It will rapidly absorb water from the air, and become diluted.

7 *Why does Alcohol preserve organic bodies from putrefaction?*

Because of its strong affinity for water, and its power of coagulating albumen.

8 *What is Proof Spirit?*

A mixture of equal parts of alcohol and water.

9. *What is the composition of the strongest Alcohol of commerce?*

Ninety per cent. of alcohol, and ten per cent. of water.

10 *What is the effect of taking Alcohol into the Stomach?*

Pure alcohol in the stomach is a deadly poison; when diluted with water it produces the well-known effects of stimulation and intoxication.

11. *What are the chief classes of Intoxicating Drinks?*

Ardent spirits, wines, and malt liquors.

12. *What are Ardent Spirits?*

They are liquids containing a large percentage of alcohol, and are the product of distillation.

13. *What is Distillation?*

When fermented liquors are subjected to a moderate heat, the alcohol they contain is separated from the water, and rises as vapor. When this operation is conducted in closed vessels, and the alcoholic vapors are collected and condensed by cooling, it is called distillation, and ardent spirits are obtained.

14. *What are the most common Ardent Spirits?*

Whisky, brandy, gin, and rum.

15. *What is Whisky?*

Whisky is ardent spirits manufactured from corn, rye, or potatoes, mixed with a portion of barley malt; the fermented liquor is afterwards distilled.

16. *What is Brandy?*

A spirituous liquor obtained by the distillation of wine. A pure article of wine-brandy is seldom found.

17. *What is Gin?*

Holland gin is ardent spirits rectified (re-distilled) from the fermented liquor of rye and barley with juniper berries. Common gin is flavored with turpentine instead of juniper berries.

18 *What is Rum?*

Ardent spirits obtained by distilling fermented molasses.

19. *What percentage of Alcohol do Ardent Spirits usually contain?*

About fifty per cent.

20. *What is Malt?*

Grain, usually barley, moistened with water and made to germinate, and afterwards dried.

21. *What are Malt-Liquors?*

Liquors made with an infusion of malt, as ale, beer and porter.

22 *How much Alcohol do Malt Liquors contain?*

English ale, from 5 to 10 per cent.; porter, from 3 to 6, and beer, from 2 to 3.

23. *What is Wine?*

It is the fermented juice of the grape; the term is also applied to the fermented juice of certain other fruits, such as currant wine, gooseberry wine, blackberry wine, etc.

24. *What is meant by the strength of Wine?*

The strength of wine depends wholly upon the alcohol it contains, and this varies greatly in the different kinds.

25. *How much Alcohol do Wines usually contain?*

The lighter wines from 5 to 10 per cent.; the stronger wines from 15 to 25.

26. *What is the effect of Alcohol on the Skin and Mucous Membrane?*

Strong alcohol applied to the skin is an irritant; taken into the mouth or stomach it will blister the mucous membrane. Diluted alcohol produces the same effects in a less degree.

27. *Why do strong Alcohol and Common Salt produce thirst?*

They both have a strong affinity for water, and when taken into the stomach absorb water from the tissues, and thus act as caustics or irritants.

28. *Does Alcohol ever slake thirst?*

No; the large amount of water in some alcoholic drinks enables them to allay thirst, but this is due to the water, and not the alcohol.

29. *Why is an Alcohol Beverage not a natural drink?*

A natural drink will allay thirst; alcohol tends to blister, burn, and inflame.

30. *What effect does the habitual use of Alcohol have on the tissues of the body?*

Post-mortem examinations show that the tissues are hardened by alcoholic drinks; this is due to the loss of their natural proportion of water.

31. *Where are the irritant effects of Alcohol most injurious?*

Upon the internal delicate membranes and tissues; hence the various abdominal inflammations of habitual drunkards.

32. *What is the usual effect of the habitual use of intoxicating liquors upon the soft tissues?*

It causes them to shrink, to harden, and to stiffen; this is especially true of the nervous tissues.

33. *What is the effect of Alcohol on albumen?*

It coagulates it; that is, causes it to become hard and solid.

34. *How may the effects of Alcohol on albumen be easily shown?*

By pouring alcohol, strong whisky, or brandy on the white of an egg.

35. *What is the effect of Alcohol on the gastric juice?*

Experiments tend to show that it coagulates and precipitates the pepsin from the gastric juice.

36. *What effect does Alcohol have on the lining of the stomach?*

It thickens and hardens the membranes, permanently dilates the blood-vessels, and in some cases ulcerates the surface.

37. *What was observed of the effect of Alcohol on the stomach of St. Martin?*

"The free, ordinary use of any intoxicating liquor, when continued for some days, invariably produced inflammation, ulcerous patches, and, finally, a discharge of morbid matter tinged with blood."—*Dr. Beaumont.*

38. *What organs of the body receive the largest share of Alcohol from the stomach?*

The brain receives most; the liver the second largest share.

39. *How does Alcohol reach the Liver from the stomach?*

It is carried directly from the stomach to the liver by the portal vein.

40. *What is the effect of Alcohol on the Liver?*

"The color of the bile is soon changed from yellow to green, and even black." In the case of an habitual drunkard the liver becomes hardened and shrunk.

41. *Is Alcohol a food?*

"It can not supply anything which is essential to the nutrition of the system, since we find not only individuals but whole nations maintaining the highest vigor and activity, both of body and mind, without ever employing it as an article of diet."—*Dr. Wm. B. Carpenter.*

42. *How do Food and Alcohol differ in their action?*

The system seizes hold of true foods to change them into nutrient blood; on the other hand, nature seeks to rid the system of alcohol, and to cast it out as poison.

43. *Can Alcohol furnish a nutriment for any part of the body?*

"That alcohol is incapable of forming any part of the body is admitted by all physiologists. It can not be converted into brain, muscle, or food."—*Cameron.*

44. *Why can Alcohol be smelled in the breath of a drunkard?*

The lungs are scavengers for cleansing the system of impurities, and they work to throw alcohol from the system, and cast it out with the breath.

45. *Is Alcohol a heat-producer?*

Alcohol is a stimulant, and its first effect is to slightly increase the temperature of the body; but soon the temper-

ature is lowered, and the reduction of temperature is in exact proportion to the amount of alcohol taken.

46. *Should Alcohol be used in very cold climates?*

"In Arctic countries alcohol is not only completely useless, but positively injurious. I have known strong, able-bodied men to become utterly incapable of resisting cold in consequence of long-continued use of alcoholics."—*Dr. Hayes.*

47. *Does Alcohol enable one to undergo severe bodily exertion?*

No; men who are in training for running, rowing, and other contests deny themselves all alcoholic liquors.

48. *Does Alcohol enable one to withstand the hardships of a severe climate?*

"The regular routine employment of alcoholic stimulants by man in health is never, under any circumstances, useful. We make no exceptions in favor of cold, or heat, or rain."—*Dr. F. H Hamilton.*

49. *Why should Alcohol be called a Poison?*

"A poison is any substance, in whatever form it may be, which, when applied to a living surface, disconcerts life's healthy movement. Such a poison is alcohol; such, in all its forms, mix it as you may. It is never digested and converted into nourishment."—*Dr. Mussey.*

50. *What is the effect of Alcohol on the waste of the body?*

Its tendency is to cause a formation of an unstable substance resembling fat, and thus to increase the weight of the body.

51. *In what way does Alcohol increase the weight of the body?*

It checks the ordinary waste of the system, and prevents the ordinary life processes of the body from going on with their healthy vigor and strength.

52. *What is the effect of Alcohol on the blood?*

It causes the blood corpuscles to shrink, and to become wrinkled and ragged.

53. *What is the comparative fatality of disease among those who use and those who do not use Alcohol?*

Diseases are generally more fatal with those who habitually use intoxicating liquors; they suffer from impurities of the blood and a weakening of the great organs of circulation.

54. *What are the four stages of the action of Alcohol?*

(1) Stimulation, (2) Depression, (3) Intoxication, (4) Unconsciousness.

55. *Describe the stimulant effects of Alcohol.*

The first effects are to arouse the system, and for a brief time to give it tone and vigor.

56. *Describe the depressing effects of Alcohol.*

The second stage of its action is depression, in which there is more or less of a chilliness and a fall of temperature, and a partial loss of mental and muscular control.

57. *Describe Intoxication*

It is the third stage of the action of alcohol, in which the organs are filled with blood, and the nervous system greatly deranged; the breathing is slower; the heart beats less rapidly, and the temperature is lower.

58. *Describe the stage of unconsciousness resulting from Alcohol.*

In this stage the narcotic effects of the drug are most marked; the individual loses all mental control, and lies helpless, with his breathing slow and clogged.

59 *What names have been given to the four stages of the progressive influences of Alcohol other than those before given?*

(1) The stage of Excitement, (2) the stage of Muscular Weakness, (3) the stage of Mental Weakness, (4) the stage of Unconsciousness.

60. *What effect does cold have on intoxicated persons?*

It has a wonderful influence in hastening the stage of unconsciousness, and to cause the inebriate to sink into lethargy, fall, and die

61 *How may we distinguish the last stage of alcoholic influence from a sound sleep?*

When a person is "dead drunk," the pulse is slow, and almost imperceptible: the face is pale, and the skin cold: if the arm be pinched it is not moved.

62. *What organ of the body seems to have the strongest affinity for Alcohol?*

The brain; this organ absorbs more alcohol than any other, and the delicate structure is correspondingly affected.

63. *What is the effect of a single overdose of alcoholic liquor on the Brain?*

The tiny vessels of the brain become clogged with blood that is unfitted to nourish, and the brain is deprived of its usual quantity of life-giving oxygen.

64. *What is the effect on the Brain of the habitual use of Alcohol?*

In time the liquor hardens and thickens the membrane enveloping the nervous matter, and the nerve capsules undergo a "fatty degeneration."—*Steele.*

65. *Name the nervous and brain diseases caused by the intemperate use of Alcohol.*

"Diseases of the brain and nervous system, indicated by such names as apoplexy, epilepsy, paralysis, vertigo, softening of the brain, delirium tremens, dipsomania or inordinate craving for drink, loss of memory, and that general failure of the mental power called dementia."—*Richardson.*

66. *What is Delirium Tremens?*

"A disease of the brain, characterized by frightful dreams and visions, and resulting from the excessive and protracted use of spirituous liquors."—*Brande.*

67. *How are the injurious effects of Alcohol on the mind caused?*

"The effects of alcohol on the mind are caused by its paralyzing and inflaming action upon the brain and other parts of the nervous system."—*Eclectic Physiology.*

68. *What is the effect of Alcohol on the will?*

Alcoholized blood weakens the will, causes indecision and a breaking of promises to reform, and, in a large measure, a loss of the power of self-control.

69. *What is the effect of habitual inebriation on the moral sense?*

"A lowered standard of veracity and dulled sense of honor quite as much as an impaired will."

70. *What proportion of the cases of Insanity are caused by intemperance?*

"It is surely within the truth to say that half the existing cases of insanity are due directly or indirectly to this social curse."—*Dr Yellowlees.*

71. *What is said of Intemperance as a cause of brain disorders?*

"With the single exception of hereditary predisposition, intemperance is by far the most fruitful of all the causes of brain disease."—*Ib.*

72. *Why can we not taste so acutely for a time after holding alcohol in the mouth?*

Because the nerves of taste are somewhat deadened by the alcohol.

73. *Why does Alcohol act as a "pain-cure?"*

Because it partially deadens or paralyzes the nerves, so that we do not feel the pain.

74. *How does Alcohol act as a Stimulant?*

"When alcohol is taken into the system its first effects are to arouse and alarm the system; for a brief season the person feels stronger; the mind is also brightened and cheered. This is called stimulation Such effects are only temporary."—*Eclectic Physiology.*

75. *How does Alcohol act as a Narcotic?*

"The use of alcohol in large quantities, or in small quantities that are often repeated, invariably causes narcotic depression."—*Ib.*

76. *Why is nothing gained by the stimulating effects of Alcohol?*

"The stimulation is followed by a corresponding depression of power in proportion as the previous excitement has been greater; nothing is, therefore, gained in the end."—*Dr. W. B. Carpenter.*

77. *When is the use of Alcohol as a stimulating medicine justifiable?*

"Its use is only justifiable where some temporary emergencies can only be met by a temporary increase of power, even at the expense of an increased amount of subsequent depression, or where it affords aid in the introduction of aliment into the system which nothing else can so well supply."—*Ib.*

78 *What caution should be used in administering Alcoholic Stimulants?*

In chronic diseases and painful affections in which alcohol may be soothing there is a constant tendency to an increase in the frequency and size of the dose, and danger of begetting intemperate habits.

79. *What is to be said of the use of Wine as a beverage?*

"Wine is consumed in most civilized countries, but in a state of health it is at least useless, if not absolutely pernicious."—*U. S. Dispensatory.*

80. *What diseases are caused by the habitual and excessive use of Wines?*

"They weaken the stomach, produce disease of the liver, and give rise to gout, dropsy, apoplexy, tremors, and not infrequently mania."—*Ib*

81. *Does Alcohol produce clearness and vigor of mind?*

No; the mental activity it excites is an unsafe state of the mind, for the proper poise of the judgment is absent.

82. *What is Dipsomania?*

It is an uncontrollable or irresistible craving for intoxicating liquors.

83. *What two forms of Dipsomania are there?*

(1) Periodical or paroxysmal; (2) Chronic or persistent.

84. *Describe the difference in the two forms of Dipsomania.*

In the first form the subject may be temperate for weeks or months, and then abandon himself to violent excess for a longer or shorter period; in the second form the subject is constantly inebriated so long as the opportunity exists

85. *Is Chronic Intemperance a disease?*

Yes; but to designate it as such is not at all to deny the accountability of those who voluntarily incur it.

86. *What are the various names for the disease of uncontrollable Intemperance?*

Dipsomania, methomania, oinomania, and alcoholism.

87. *What cure is there for this disease?*

"No safety exists except in seclusion for a year or two where the individual can not obtain stimulus, and is not made by company to desire it."—*Dr. Henry Hartshorne.*

88. *How should the State treat the inebriate?*

"Laws should be passed by which every person, proved upon inquiry before a commission to be habitually intemperate, should (like a lunatic) be deprived of the control of his liberty and property."—*Ib.*

89. *How long a time should the inebriate be secluded and restrained?*

"Never less than a year; better two years."—*Ib.*

90. *What are Inebriate Asylums?*

Home-like retreats for the seclusion and restraint of the habitually intemperate. "The success so far obtained in these retreats has been quite enough to justify their establishment and support near every large city."—*Ib.*

91. *What is Fatty Degeneration of the Heart?*

It consists of the substitution of fat for the muscular substance of the heart.

92. *What influence has Alcohol in causing this disease?*

"A remarkable influence: malt liquors seem to be more effective in causing the fatty growth than spirits, but any form of alcoholism conduces to it."—*Dr. J. R. Reynolds.*

93. *What is Bright's Disease?*

A dangerous and often fatal disease of the kidneys, due to a deteriorated or corrupted condition of the blood.

94. *Does Intemperance produce Bright's Disease?*

"The abuse of spirituous liquors is a prominent determining cause of Bright's disease."—*Dr. J. R. Reynolds.*

95. *What proportion of cases of this disease are due to Alcohol?*

"Dr. R. Christeon estimates the proportion of cases in Edinburgh due to intemperance as three-fourths or four-fifths of the whole number."—*Ib.*

96. *Are all dram-drinkers liable to diseases of the kidneys?*

"Dr. Christeon observes that dram-drinkers who regularly take ardent spirits several times a day, but short of intoxication, are liable to diseases of the kidneys as well as drunkards."—*Ib.*

97. *What is a Narcotic?*

A drug which diminishes or suspends the function of the nervous system after a preliminary stage of excitement.

98. *In what do all Narcotics agree?*

"The effects of all of them are expended chiefly on the nervous system; they stimulate the functions of the brain, but this stage of excitement, which may be of shorter or longer duration, is followed by sopor, coma, and complete insensibility."

99 *Is Alcohol a Narcotic?*

It is classed by the best writers on materia medica as a true narcotic.

100. *What is Tobacco?*

The tobacco of commerce is the dried leaves of the plant *nicotiana tabacum.*

101. *What is Nicotine?*

It is a powerful alkaloid found in tobacco: it is an oily, colorless liquid with a hot and acrid taste.

102. *What are the physiological effects of Nicotine?*

It is a severe and depressing nauseant and emetic, a local irritant, and produces burning pain at the epigastrium.

103. *Is Tobacco used in medicine as an external application?*

It formerly was, but so many unfortunate accidents have resulted that now its use in this way is rare.

104. *What distinction is there between the narcotic effects of Alcohol and Opium, and of Tobacco?*

Alcohol and opium are cerebral sedatives; tobacco is a motor depressant.

105. *What is a Cerebral Sedative?*

An agent which quiets or suspends the action of the cerebrum

106 *What is a Motor Depressant?*

An agent which depresses the motor functions of the spinal cord and sympathetic system.

107. *How much Nicotine is there in Tobacco?*

On the average, Havana contains about 2 per cent.; Virginia about 6 per cent.; some kinds contain 7 per cent.

108. *What is said of the strength of the poison of Nicotine?*

The amount contained in two cigars, if thrown directly into the blood, would cause death.

109. *Give the principal chemical constituents of Tobacco*

Carbonic acic, carbonic oxide, ammonia gases, carbon, and nicotine.

110. *What is the effect of the carbonic acid of Tobacco?*

It tends to produce sleepiness and headache.

111. *What is the effect of the carbonic oxide of Tobacco?*

It causes a tremulous movement of the muscles and of the heart.

112. *What is the effect of the ammonia of Tobacco?*

It bites the tongue of the smoker, excites the salivary glands, and causes dryness of the throat and muscles.

113. *What is it that gives the peculiar odor to the breath and clothing of the smoker?*

The nicotine of the tobacco; it also gives the sickening taste to an old pipe.

114. *What is the effect of Tobacco upon the human system when first used?*

It causes nausea and headache; giddiness also ensues from the irritation of the motor nerves.

115. *What is the effect of habit in the use of Tobacco?*

The system becomes adjusted to the functional disturbances, and craves the narcotic influences.

116. *How does Tobacco act as a stimulant?*

By cutting off the nervous supply from the extremities, and concentrating it upon the nerve centers.

117. *What organs suffer most from the use of Tobacco?*

The stomach, the liver, the heart, and the nerve centers.

118. *What is the worst effect upon the mind?*

By its narcotic effects, its use fixes upon the system the most slavish conditions of the will, and blunts and degrades the mind.

119. *What is the effect of Tobacco on the eye?*

"It produces dilation of the pupils and confusion of vision."

120. *What is the effect of Tobacco on the mucous membrane?*

Redness, dryness, and occasional peeling off of the membrane, and sometimes that fatal disease, cancer of the throat.

121. *What is Opium?*

The dried juice of the poppy.

122. *What is meant by the Opium Habit?*

It is the habitual use of the drug or its tinctures or alkaloids for their narcotic and sedative effects.

123 *Name the different forms of the Opium Habit.*

Some smoke or chew the gum, some swallow morphine, laudanum, or paregoric, or inject some form of the drug under the skin.

124. *What are the effects of Opium in medicine?*

In small doses it allays pain, and in larger ones soothes to sleep.

125. *What is the effect of Opium-Eating on the mind?*

It arouses the brain and fires the imagination to a wonderful pitch; following this unnatural exhilaration is a corresponding depression.

126. *What is said of the appetite for Opium?*

Its use tends to produce an uncontrollable appetite, and the dose must be gradually increased to produce the original exhilaration.

127. *What is said of the strength of the Opium Habit?*

It is the most tyrannical habit known to man; few possess the determination to escape its fetters.

128. *What is said of the Hypodermic Injection of Morphine?*

The operation is nearly painless, and it may cause instant relief from pain, but it is as injurious and dangerous as opium-eating.

129. *Why is relief from pain more speedy when morphine is injected into a vein than when taken into the stomach?*

In the former case the narcotic influence is thrown at once into the circulation.

130. *In what respect is the Opium Habit worse than the use of Alcohol or Tobacco?*

"The victim of the opium habit is bound to a drug which must be taken at certain times with inexorable regularity; the liquor or tobacco-user can for a time go without the use of these agents, and no regular hours are necessary. The opium-eater has no such reprieves."—*Hubbard.*

131 *What is Chloral Hydrate?*

It is a narcotic drug used in medicine to relieve pain and to produce sleep.

132. *What is said of the sleep produced by narcotics?*

It is not a natural sleep; while it gives rest, it does not restore and recuperate the body and mind as natural sleep.

133 *Should narcotic drugs ever be used?*

They may be taken on a physician's prescription as a sedative from racking pain, but their habitual use is a practice that tends to the most fatal results.

134. *Why are the same drugs sometimes called stimulants and sometimes narcotics?*

Because they produce both a stimulating and a narcotic effect; stimulation is the first and lethargy the second effect.

135. *What is meant by the Law of Heredity?*

The law by which qualities are transmitted from parents to children

136. *To what qualities does the Law of Heredity extend?*

To the physical, mental, and moral. "The life of each individual is, in some real sense, a continuation of the lives of his ancestors."—*F. Galton.*

137. *Are the evil effects of Alcohol transmissible?*

Yes. "Of all agents, alcohol is most potent in establishing a heredity that exhibits itself in the destruction of mind and body."—*Dr. Willard Parker.*

138. *What do the Intemperate transmit to their children?*

"There is not only a propensity transmitted, but an actual disease of the nervous system."—*Ib.*

139. *What ancient philosophers have spoken of the inheritable nature of Intemperance?*

Aristotle says, "Drunken women have children like unto themselves;" and Plutarch remarks, "One drunkard is the father of another."

140. *How may Tobacco lead to the use of Alcohol?*

"Tobacco causes thirst and depression that only too often and naturally lead to the use of liquor"—*Steele.*

141. *What evils may be inherited from the Tobacco-user?*

"An impaired constitution and a tendency to nervous complaints"—*Ib.*

142. *Where is Alcohol sometimes found collected in the brain of drunkards?*

"The use of the ventricles of the brain has not been determined; it is a curious fact, however, that a post-mortem examination of the brain of inebriates frequently discovers the cavities to be partially filled with alcohol."—*Hitchcock.*

143. *What is the objection to the moderate use of Narcotics?*

Their use, even in such moderate quantities as to produce no perceptible injurious effects, creates a craving which

will not be satisfied except by the use of increased quantities.

144. *What is an Anæsthetic?*

This term was proposed by Oliver Wendell Holmes, and is used to mean an agent which produces insensibility to pain.

145. *What is Anæsthesia?*

It is a state of profound unconsciousness induced by the use of anæsthetics.

146. *What are the most common and powerful of Anæsthetics?*

Chloroform and Ether.

147 *Describe the physiological effects of Chloroform.*

The first effect is a general exhilaration, or cerebral intoxication; if the inhalation continues, the patient passes into a condition of complete insensibility.

148. *What fact has been discovered concerning the effects of Chloroform on drunkards?*

Experience has shown that old drunkards are peculiarly unfavorable subjects for the administration of chloroform. Instances of sudden death in such cases are relatively numerous —*Bartholow.*

149. *What is Local Anæsthesia?*

The diminution of the cutaneous sensibility in surgery by the application of cold and freezing mixtures

150. *How is Local Anæsthesia produced in dentistry?*

Usually by the application of a current of ether against the part to be rendered insensible.

151. *What is Laughing Gas?*

A colorless, inodorous gas, known in chemistry as Nitrous Oxyde. It is an anæsthetic employed in dentistry and minor surgical operations.

152 *Describe the physiological effects of Laughing Gas.*

The first effect of its inhalation is a dizziness, noises in the ear, and a tingling throughout the body. Extraordinary illusions then beguile the senses, and the intoxicated subject breaks forth into singing, declaiming, laughing, sobbing, or manifests a pugnacious tendency. When the effect ceases the subject is often surprised at the ridiculous position in which he finds himself.

QTA H364o 1887

61420300R

NLM 05054200 0

NATIONAL LIBRARY OF MEDICINE